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IN THE NEW COMPUTER ERA

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THE ROLE OF THE EXECUTIVE IN THE NEW COMPUTER ERA

We are now in the early stages of "the third era" of computer utilization. This new era is not a mild evolution from its predecessors. Rather it is an abrupt revolution in the ways that computers can be utilized in the corporation. Most important, the third era's capabilities are putting significant demands on corporate executive leadership.

Corporate management has in almost all cases in the past, in effect said "Let Harry do it." Responsibility for use and management of the computer resource was delegated to the "Harrys" of this world - the Information Systems Managers. Today, for a number of reasons, this position is no longer tenable. In my opinion, executive management must now be involved. There are a number of reasons for this. The computer and communication resource has now become integral to many companies strategies. There is an excessive demand for computer resources on the part of all in the organization. Information systems people are, in general, poorly equipped to meet the new technological challenges, and, finally, the new era demands many new corporate policies which must be set at the highest level.

I would like to center today on six key trends which, to my mind, are basic in understanding what has brought about this new era, and on a description of the era. These, in turn, will give way to a discussion of three major management implications. These are (1) a need to manage the end user computing environment; (2) a need to rethink the changing role of corporate I/S management; and (3) the need for executive involvement and leadership with regard to the computer/communications resource.

*This paper is the text of a presentation delivered at the Symposium for Senior Executives, MIT Industrial Liaison Program, June 1983.

Six Key Trends

For the executive concerned with the computer resource there are six major trends which are of most significance. These are:

1. Decreasing hardware unit costs. The costs of computer hardware has decreased by 20-30% per year over the past two decades and will continue to do so for the foreseeable future. Thus, raw computer power, as demonstrated most recently by the personal computer, is rapidly becoming within the cost-beneficial reach of almost everyone in the corporation.

2. Inflation. This needs no discussion. The cost of "labor" of all types in the corporation has increased vastly over the past two decades and will, it appears, continue to do so although perhaps at a somewhat reduced rate. This clearly encourages the use of computer-based systems to replace, or assist, people wherever possible.

3. Cost of Communications. Communication costs have decreased somewhat, over the last several years, but not nearly at the same rate as the reduction in hardware unit cost. This ratio, together with the far better response-time characteristics of "local" machines as opposed to remote centralized systems, has enhanced the trend toward increasingly "local" systems and a move away from the centralized computing credo of yesterday.

4. Software Development Costs. The unit costs of producing software, affected both by increasing labor costs and ever-better programming tools, has stayed approximately stable. The greatest hope in this area is the development of increasingly better tools for use by end users to "program" their access to data thus eliminating the need for involvement with a professional I/S group wherever possible.

5. New Technology. New computer technology, hardware and software alike, is being delivered to the market today at an ever-increasing rate. This is enabling the development of a significant number of applications previously not feasible.

6. User Demand. Given all the conditions above, the demand to make use of the computer/communications resource by managers and others at all levels in the corporation has skyrocketed. Dealing today with inflation, quality questions, and a need for increased productivity, managers increasingly perceive an absolute imperative to make use of the computer in all aspects of the value-added chain in the corporation.

The Third Era.

The above trends have jointly led to a new era in computing. We have, in fact progressed through three different eras of computing usage, (See Figure 1.). The first two were essentially concerned with automating the paperwork-processing functions of the firm. In the first era, computer systems were installed primarily to automate accounting functions. Payroll systems, accounts payable, and general ledger systems were instituted on increasingly powerful computer systems throughout the world. Because computer hardware was expensive, systems and the personnel to operate them were centralized to obtain higher productivity. A set of tools such as project management tools were developed. COBOL was determined as the key computer language. The data processing manager was a "line" manager with all his people reporting directly to him.

In the second era the emphasis changed from systems serving the accountant to those designed to assist first-line operational personnel. Applications in this era included manufacturing control systems and on-line order-entry systems. As with the first, most of the second wave of systems merely enabled companies to do what they had previously done with regard to paperwork processing in a faster more accurate manner. However, the on-line nature of these applications and the need to access, in most cases, only local databases tended to move the computer systems closer to their users. We moved from an era in which "centralized" computing was paramount to one in which "distributed" computing, utilizing both central and local machines, became the norm. Moreover, in the second era, as the applications changed, the process of information

Figure 1 - The Three Eras of Computing

Era	Applications	Hardware	I/S Tools	I/S Managemen
(1) Accounting)	<ul style="list-style-type: none"> - Payroll - Accts. Pay. - Gen. Ledger 	<ul style="list-style-type: none"> - Cent'd - Maxis - Batch 	<ul style="list-style-type: none"> - Project Mgt. - Cap'y Mgt - COBOL 	<ul style="list-style-type: none"> - Line
(2) Operations)	<ul style="list-style-type: none"> - <u>Order-Entry</u> - <u>Manufac-turing Control</u> 	<ul style="list-style-type: none"> - Decent'd - <u>Minis</u> - <u>On-Line</u> 	<ul style="list-style-type: none"> - Project Mgt. - Cap'y Mgt - COBOL 	<ul style="list-style-type: none"> - <u>Matrix</u>
(3) (Information)	<ul style="list-style-type: none"> - <u>DSS</u> - <u>XSS</u> - <u>?</u> 	<ul style="list-style-type: none"> - C/DC - On-Line 	<ul style="list-style-type: none"> - <u>Evolut'y</u> - <u>Desian</u> - <u>Budget</u> - <u>RAMIS,</u> - <u>FOCUS</u> et. al. 	<ul style="list-style-type: none"> - Matrix - <u>Staff</u> - <u>Support</u> - <u>Everyon</u> <u>a User</u>

systems management also changed. In this second era, as computers were distributed throughout the company, so were information systems personnel. The Director of Information Systems thus had to become a matrix manager with a "dotted-line" relationship to distributed information system personnel and all the problems inherent in such an organization structure. The process of I/S management thus became much more complex.

During the past several years, however, a "third wave" of computer applications has begun in earnest. Following the "accounting" and "operational" systems eras, this new era of applications can be termed the "information-communication" application era. As opposed to paperwork processing, these applications are concerned with both access to and use of information and communication within an organization. The previous application era served the lower levels of corporations. Today, third era applications serve middle management, key staff personnel, and even the executive suite. The applications, which include decision support systems, executive support systems, end user computing of all types, electronic mail, and computer conferencing are unique and significant in several ways. These are:

- * The procedures (for decision making and other uses) exist primarily in the minds of the managers and staff personnel who utilize them.
- * It is impossible to justify these applications in traditional cost-benefit ways.
- * Traditional means of systems development - through well defined project management techniques - are no longer applicable.
- * The software languages being utilized are an entirely new breed - often not understood by the majority of information systems personnel.

- * Significantly higher quality information systems personnel are necessary to work with these applications than was required in the past.

- * Demand for access to data and the ability to communicate with those in the corporation is coming from all quarters of the corporation, as opposed to being centered in one or more paperwork-processing clerical groups.

In short, we are in a vastly new era whose tools, techniques and managerial demands on the corporation are significantly different. Demands for this sort of computing are growing at 50 - 100 % a year in most organizations today, approximately 5 - 10 times faster than the more traditional applications. What is more, there are a significant number of trends which are accelerating this demand. These trends, noted below, in Figure 2, can be summarized into technical factors, more computer-savvy managers, and business conditions which are leading to the increased use of information and an increased need for communication.

Figure 2 Factors Accelerate the Demand for Third Era End User
Computing and Communication

Technical Factors

- * Vastly improved end user software
- * Micro computers
- * Electronic mail, office systems
- * Hardware cost
- * User frustration with Cobol-based systems
- * Availability external databases
- * Availability internal databases
- * "Programmer" availability

More Computer-savvy Managers

- * New generation of users
- * Salesman direct calls
- * Managerial journals
- * Demonstration effect

Business Conditions

- * Interest rates
- * Inflation
- * International competition
- * Need for improved planning and control

Information Databases

One major result of the "third wave" of applications is the development of a "third environment" for computing. In the past, the information systems organization has supported two strikingly different environments. One is the "COBOL" environment in which the data processing shop has had full command. It designs the applications, programs them, schedules them and runs them. In addition it has full responsibility for database maintenance and all other aspects of these systems. In the second, or time-sharing, environment to the contrary, the information systems group merely provides available hardware and software languages. The user does everything else - his own programming, running, database maintenance etc.

The growth of significant end user computing has necessitated a "third environment". In this environment, users and information systems jointly share the responsibility for the development and operation of systems. In general these systems are large departmental or corporate-wide databases supporting users in such as market research, personnel or the executive suite. For these systems, the information systems organization maintains the database, provides a continuously available operating environment, and assures that network communication is available. The users, however, do all the rest. They develop their own programs and run the systems when they so desire. Many of the "programs" are simple accesses to the database, although some are used for deeper analysis.

This third or "shared" environment is becoming a more and more significant part of the information systems scene. It relies on several new tools, most particularly end user languages and relational or pseudo-relational databases. It demands cooperation between users and the information systems organization to a degree previously unknown in the first two environments. Finally, it requires new policy guidelines.

Major examples of these "third environment" systems can be found in both staff areas and at the executive level. One example is IBM's market research system, a system now including in excess of nine billion characters of data concerning customers, industries and economic conditions worldwide. The system is accessed by more than a thousand people concerned with marketing throughout IBM who utilize two end user tools, APL/DI and APL. A second example, a superb example of an executive database, used by the entire corporate office, is found at Northwest Industries. (reference 1) There, Ben Heineman, the Chief Executive Officer, other top line personnel and the key corporate staffs all access a large data base including both internal data on Northwest Industries and its subsidiaries and external data on Northwest's competitors, industries, and the economy as a whole.

Managerial Implications

The third era is a revolution in computing. It has created a new computing environment, it utilizes totally new tools and techniques, and - most important - has provided users, for the first time, with direct access to computing power. For top executives there are three significant implications of this era. These are the need to develop new rules, processes, and organization structures to manage end user computing; the need to rethink the role of corporate information systems management; and the need for executive leadership and involvement.

For the information systems department the management of end user computing is an entirely new ballgame. To spread the use of information systems from a few major "customers"(such as the people responsible for payroll, accounts payable etc.) to the entire organization requires a new information systems organization structure, a new strategy, and new methods of support of users in an era in which practically everyone in the organization will have a terminal on his desk. This task for the information systems department is akin only to a company moving from the industrial sales market (with a few major customers) to retail sales. An

entirely new organization must be developed with new marketing channels and entirely new methods of field support. Some major organizations have faced directly into this new challenge. Most, however, have not.

In like manner, the role of the Chief Corporate Information Systems Executive has changed significantly in the new era. Often, he is no longer a line head of a computing organization but a staff person in the corporation. With ever more widespread computing, he must give up his role as the direct czar of computer resources. Rather, he must move into a role of providing staff expertise, guidelines, and policies so that almost totally decentralized computing organizations will be able to carry out their tasks and support their end users in appropriate ways. Most important, corporate strategies are now becoming increasingly dependent upon effective use of computer and communication potentials. As a result, a major segment of the role of the new corporate Chief Information Officer is concerned with providing expert advice to the top executive group as to the potential opportunities available through the technology to improve, redirect, or substantially change existing corporate strategies.

In this new era, corporate executives can no longer afford to "let Harry do it". One major reason for involvement is to ensure that the most appropriate use is being made of the new computer and communication technology in the development of corporate strategy. A second reason is to ensure that the corporation is not bogged down in first and second era use of computing without paying enough attention to less easily justified but extremely critical third-era computing. Third, there is a need for new corporate policies as a result of the increasingly wide spread access to data engendered by the third era. New privacy and security policies must be originated. In addition, corporate policy with regard to new justification methods and levels of investment in computer-based technology must be ascertained.

A final major reason for executive involvement in computing today is the opportunity for top executives to define, for the first time, their own information needs. Techniques we have developed at the Sloan School (references 2, 3) have been found to be very useful in doing so. For the first time, there is an opportunity for senior executives to be able to get to the data they need when they need it. To gain this facility, top management must invest both time and energy to capitalize on this opportunity. A rising tide of senior executives is doing so at this time.

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