THE LINE TAKES THE LEADERSHIP

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When George A. L. David, formerly head of Otis North America, now CEO of Otis Elevator Co., conceptualized an approach to elevator maintenance based on a centralized computer communications network, he had no idea that his system would become one of the notable examples of the use of information technology to gain "competitive advantage." Yet, the story of the major improvement in customer service made possible by OTISLINE, the Otis system, has been told and retold from the lectern and in the trade press.

The system itself is striking. Previously, loosely coordinated, decentralized maintenance efforts were carried out in more than one hundred local offices; now Otis centrally electronically coordinates the efforts of its nationwide repair force. Trouble calls are received by highly-trained, often multilingual operators who work from a computer screen to record all data concerning the problem elevator. A repairman is dispatched via a telephone/beeper system. Upon completion of the maintenance, all requisite information is once again recorded in the computer.

The advantages the system provides to Otis are manifold. Perhaps most important is senior management's increased ability to view the status of maintenance efforts nationwide. The attention of a specialist can quickly be directed to a particular customer with a difficult problem. Frequent trouble from a specific type of elevator or a geographic locality can be observed as the pattern develops, and corrective action taken. The quality
of telephone response to anxious customers can be closely monitored. And fault data, available both to management and to the company's engineers and designers, is more precise, more copious, and more accessible than the information which had previously worked its way up through the five-level geographic chain of command.

Although this now rather well-known story is fascinating in many of its elements, one often overlooked factor is particularly significant. The system was conceptualized and its implementation driven not by information systems personnel, but by George David himself. Ed Burke, Otis's Director of MIS, asserts, "It was, and is, George's system. He saw the need. He saw the solution. I helped, but he made it happen."

Even a few years ago, executives like George David would have been relatively unique in personally developing a strategic use of information technology. Today, however, there is a small, but rapidly growing number of senior line and staff executives who are taking the responsibility for significant strategic projects centered around computer and communication technology in their companies, divisions or departments. A pattern of emerging "line" responsibility for such projects is now becoming clearer. This paper presents some conclusions derived from a study of line* executives in fifteen companies who have been proactive in their use of information technology.

For the first three decades of the computer era, the key figures in

*The word "line" is used to encompass all managers - whether line or staff having responsibility for a major segment of an organization.
information technology use were the information systems (I/S) professionals. Today, for a number of reasons noted below, the shaping of key information systems direction is passing to line managers. Unwilling any longer to delegate the strategic or major tactical uses of this technology to the information systems department, these managers are taking the lead in applying information technology to the most important areas of their businesses. Many, as at Otis, are utilizing the technology as a core element in aggressive new approaches to the marketplace or to enhance control of internal operations.

Including information technology as a significant component in business planning and, thus, in the process of conception of new business strategies and tactics, is only one part of an emerging information technology leadership role for senior executives. The other, and equally important, element of this role is the active direction of the implementation process for the new systems. The logic underlying the need for both pieces of this role will be examined later in this article. First, however, let us look at a few other examples of "the line taking the leadership".

Some Examples

- Three years ago, Bob Campbell, President of the Refining and Marketing division of the Sun Corporation, identified crude oil trading as perhaps the key business activity in his organization. He gave Woody Roe the job of improving Sun's efforts in this area. Roe quickly realized that the trading process was dispersed to a large number of groups located worldwide -- each acting relatively independently. Some reported to the management of other Sun divisions.
Although he had no prior information technology background, Roe envisioned a central trading room supported by information from Reuters and a number of other trade data sources. He turned to Sun's information technology department for the technical design of the system, but then set forth himself, with Campbell's support, to initiate the key process and organizational changes needed to make the system effective. Today, centralized, on-line trading is recognized by Campbell and other Sun executives as a major weapon in Sun's fight for increased revenue and profit in its very competitive industry.

Dick Kennedy, while President of the Vitrified Products Division of the Norton Company, developed a strategic plan heavily based upon the use of information technology. Realizing that his division, which manufactured grinding materials, was in a very mature business, Kennedy focused on two critical success factors - low cost and excellent service. His business strategy was to make his division of Norton the international leader in both areas. To do so, he initiated a set of major information technology projects ranging from the "Norton Connection" (a computer-based telecommunications link between Norton and its distributors), to a more effective order processing system, to a series of manufacturing technologies ultimately targeted at flexible manufacturing and automated materials control. Implementing several large, extremely complex systems at the same time is far from simple. But Kennedy had
accomplished much of this, with considerable bottom-line impact, before Norton executive management recently combined his division with several others in a sweeping organizational realignment.

In a similar manner, Jerome Grossman, President of the New England Medical Center (NEMC), has taken the initiative in using information technology to help him manage a 450-bed major teaching hospital in Boston. Drawing upon his knowledge of the technology, he designed a "product-based" planning and control system of which any industrial manufacturing manager would be proud. The system, built with a relational data base, now provides a wealth of information for future planning, day-to-day management and retrospective analysis of the medical center's operations.

The system itself is simple enough in concept. Each "product" the hospital delivers (e.g., a heart by-pass operation) has a list of the resources (nursing hours, x-rays, etc.) which will be used to help the patient. This "product/resource" list (or bill of materials) is used in three major ways. First, for annual planning purposes, the expected number of patients in each category can be multiplied by the resource requirements for each, and the institution's total resource needs in x-ray, laboratories, etc., can be roughly estimated. Second, as patients are treated, the institution can monitor the use of resources by resource category, by department, by "product", or by physician. Third, comparisons can be made as to expected vs. actual resource utilization by case type to help set prices in the future.
A sweeping change of this type, from simple year-to-year budgeting processes to much more specific, detailed management of resource utilization through the use of state-of-the-art information technology, took innovative thinking to conceive. But the real work had just begun. Implementing this new management system -- which smacked strongly of "uncaring industrial practice" -- took significant education and persuasion by Dr. Grossman of all members of his management team, the medical staff, and the trustees. Only a senior executive who was strongly committed to this managerial strategy could possibly implement such a system. It is now in place at NEMC.

If "war is too important to leave to the generals," the deployment of information technology is far too important, in 1988, to be left to information technologists. For a multitude of reasons, a growing number of line managers have come to this realization and are "taking charge" of the use of information technology in their organizations.

It is, however, primarily in the development of major new projects and systems, as in the above examples, that line involvement with information technology is evident. It is innovative in this area that the limited time of senior management can be most effectively utilized today. The new role of the line has not, however, diminished the power and influence of information systems executives. As the final section of the paper notes, a host of important information management functions are increasingly evident today -- functions which must be performed and managed by information systems professionals.
The Fourth Era -- Line Leadership

What each of the managers in the above examples has either explicitly or implicitly realized is that, in the past few years, information technology has gone through a radical change. This has resulted in changes in both the uses of information technology (the applications), and the ways that the technology can most effectively be managed. In fact, this is the fourth major change in the technology. Each technology change has, in turn, led to a different "era" of applications and different managerial processes. These eras can be termed (after the applications each enabled) the accounting era, the operational era, the information era, and the "wired society."

The "Accounting Era" -- I/S dominance. In the 1950s and early 1960s, with only batch processing technology available, commercial computer use centered on the applications of the accountant who, conveniently, carried out his payroll, accounts payable, and other operations in batches. In those early days of computers, the information systems staff was totally in charge of all systems efforts. The computer professionals were responsible for the conceptual design, the programming, the implementation, and the operation of the system. In many cases the relevant manager (in charge of payroll or accounts receivable, for example) was more a "subject" of the new system than a contributor to it. The information systems staff swept into his department, interviewed all the clerks, and designed the systems -- most of which were barely understandable to anyone outside of the computer hierarchy. Operating
managers stood to the side, providing some assistance and guidance, but the responsibility for all parts of the system design and implementation process rested clearly with the information systems people.

The "Operational Era" -- line involvement. As on-line systems and direct access files became available and computers grew to be faster and more reliable, it became feasible to computerize the key logistical (operational) systems of the firm. Since these systems required continual real-time updates (e.g., withdrawals and additions to inventory files) and direct access to their current status, they could only be effectively implemented in an on-line environment. While I/S dominance worked reasonably well for a few of this era's simpler systems, the evident implementation failure of more complex systems (e.g., manufacturing scheduling) made it increasingly clear that line management had to share in defining the system's objectives, to ensure that the appropriate functionality was present, and to be reasonably certain of its benefits. Thus began an era of "involvement" of line managers in the conceptualization, design and implementation of systems. Despite good intentions, however, the actual range of line understanding of, and involvement in, the systems of this period varied widely. In most instances, there was little doubt among the participants as to who was ultimately responsible for the success of the system. It was still the information systems department.

The "Information Era" -- individual decision support. The availability of improved, "fourth-generation" user languages and relational data bases, as well as the personal computer, ushered in a new
era in the late 1970s and early 1980s. During this time, the focus changed from transaction processing, which epitomized the first two eras, to the use of information. Able, at last, to access and manipulate data and text, individual users revelled in the ability to "do their own thing." Many analytically-oriented decision support systems were created. Staff personnel worked hard to understand and exploit the new opportunities for information acquisition and manipulation. Information systems management set up information centers and other end-user support organizations, and turned much of the responsibility for end-user programming and information access over to the users. Yet, information systems management retained its responsibilities for developing and maintaining databases; setting computer and telecommunications standards, and many other key aspects of information technology. The seeds for line leadership in all aspects of computing were sown. Yet, what emerged from this era of application was a "partnership" between the users of information (who decided what they wanted to do, and did some programming) and the information technology organization (who provided networks, enabled access to data, etc.).

The "Wired Society" -- line leadership in strategic systems. Vastly improved communications capability has been the key technology change driving the most recent era. Combined with ever more cost-effective computer hardware and software, cheaper, higher band-width communications have led to the fourth era, perhaps appropriately characterized as the "Wired Society." The term is relevant since a significant aspect of this era's applications is the "wiring" together of suborganizations within a
single firm and, more strikingly, of firms to each other. At Sun, crude trading information flows to one location. At Otis, the geographically-distributed repair offices are no longer as independent. They are logically and physically "wired" to the corporate office. At Xerox and Hewlett-Packard, design, engineering, and manufacturing functions are now closely intertwined in the development of new products. Norton, and a number of other companies, are closely attached to their customers through terminal-based order entry systems.

It is this multi-organization, multi-function aspect of key fourth era systems which make line leadership imperative. Significant business understanding, existing primarily at senior levels, must go into system conception. Equally important, effective implementation of these systems, as noted below, most often requires significant organizational changes. Information technology management cannot effect these changes. Only line management can. The next sections develop this logic more fully.

**Line Leadership in Both Conception and Implementation**

Significantly, an entirely new level of business opportunity, complexity, risk and reward has been opened up by the new communications-intensive information technology. Vastly greater managerial attention to the use of the technology is now demanded. The exact form of a system which, for instance, might link the business to its customers, is, or now should be, the result of a strategic managerial decision. Line managers must ensure that appropriate features are
embedded into the system to support the chosen strategy. The exact data to be gathered by salesmen with portable computers, for example, as well as the functionality of the system and the periodicity and rapidity with which data is gathered, is most appropriately dictated by line management.

As information technology becomes an increasingly important part of the ongoing, integral operations of the business, its use should be shaped by the managers running that business. More significantly, however, if they are to be operated effectively, today's systems, as at Otis, Norton, and Sun, almost always require major, sometimes radical, alterations in an organization's structure, personnel, roles, and business processes -- sometimes even in the culture of the corporation itself. Thus, the economic, behavioral, and political consequences of today's striking new uses of information technology should be well thought out and the requisite change processes effectively managed by those responsible for the management of the business itself. As Dudley Cooke, Sun's general manager of information systems, notes, "All the information technology people can do is effectively provide the appropriate technology platform, and program the system and install the equipment. It is the task of line management to make the extremely difficult, but very necessary, changes in personnel, roles, allied systems, and even organization structure which are required to make today's uses of information technology pay off for the company."
It is this implementation role of the line which is perhaps most significant. Kavin Moody, Gillette's senior information systems executive, is just one of a number of I/S executives who stress the importance of this role -- the logic for which is presented in the following section.

The Organization as a "Dynamic Equilibrium"

The fact that major changes in information technology can profoundly affect the people, processes, structure and strategy of an organization was initially documented in the pioneering theoretical work done by Harold Leavitt at Carnegie-Mellon University and by Alfred Chandler at MIT. Although these two men came from different academic backgrounds and were doing research in different fields, they quite independently developed compatible points of view.

Interested in comparative business history, Chandler (1962) investigated the changing strategy and structure of large industrial organizations in the United States. He found that changes in an organization's structure followed changes in the firm's strategy and that organizational structure often had to be modified continuously until it was effective in supporting the firm's strategy. Chandler also focused on individuals and their roles in organizations and in organizational changes. He found that particular individuals played unique, often new and crucial roles in developing the "fit" between the organization's evolving strategy and an appropriate structure. In addition, he noted that many structural changes and shifts in strategy were caused by
changes in the technology. For example, DuPont took advantage of new chemical processes to move from being a munitions supplier to dominating the industrial chemicals markets by broadening its strategy and opening up that new field. One can readily recast Chandler's "structure follows strategy" into four of the five interacting elements portrayed in Figure 1.

Coming from an entirely different direction, Leavitt (1965) concluded that any organizational analysis should include four components: task, technology, people and organizational structure. He saw one of management's key functions as maintaining a "dynamic equilibrium" among these four elements. Although Leavitt's main interest was in the individual and that person's fit with the organization, he too came up with the four factors of task, technology, people and structure. The theoretical underpinnings of Leavitt's work came largely out of the field of social psychology and drew on the work of Chapple and Sayles (1961), Argyris (1957), and others.

In a paper that discussed the impact of information technology on corporate strategy, Michael Scott Morton and I modified Leavitt's approach (Rockart and Scott Morton, 1984). First, we changed his generic "task" into the broader concept of the organization's strategy (Figure 1). This does not violate Leavitt's conceptual structure, since "strategy" represents a summing of the tasks of an organization. Second, we included an additional box for "management processes." Management processes are placed in the middle of the diagram because we see them as
Figure 1

LEAVITT'S BALANCING ACT (Adjusted)
part of the glue that holds the organization together. Here we include such processes as those by which the strategic plan is created; the meetings, discussions, and evaluations that result in the annual budget or the capital budget; the compensation process; and the personnel management process. Every organization has such processes, and they represent a good deal of what is done in an organization.

Implementation as Transformation

Leavitt's conceptual structure, as modified in Figure 1, is very useful in our understanding of the necessity for line leadership in the fourth era of information technology. Figure 2 notes four major stages of applications development. In Era 1, the accounting era, the data processing people carried out all of the functions -- system conception, design and programming, implementation and operation. Today, in Era 4, while the bulk of design, programming and operation remains as the domain of information technologists, the conception and implementation steps need to be line-dominated functions.

The logic behind the need for line management involvement in the system conception step is straightforward. The people who run the corporation, the division, or the department are the people who must have the vision of the direction(s) in which they plan to drive their organization. Appropriate use of information technology can be a major factor in the accomplishment of the vision. Just as the effective leader plans to deploy his key people to significant tasks, so must he guide the most effective use of information technology.
Figure 2

FOUR MAJOR STAGES OF APPLICATIONS DEVELOPMENT:

The Issue is Leadership in Stages of Project Management

<table>
<thead>
<tr>
<th>Era 1 (accounting)</th>
<th><strong>Systems</strong></th>
<th><strong>Design &amp; Programming</strong></th>
<th><strong>Implementation</strong></th>
<th><strong>Operation</strong></th>
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<tbody>
<tr>
<td><strong>Conception</strong></td>
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Era 4 (wired society)

<table>
<thead>
<tr>
<th><strong>Line</strong></th>
<th><strong>I/S</strong></th>
<th><strong>Line</strong></th>
<th><strong>I/S</strong></th>
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The need for line involvement in implementation is more complex, but equally compelling. Figure 1 suggests why. Any change in the technology will lead as Leavitt notes, to changes in all, or most of, the states of the other four elements. In fact, the systems described earlier have all led to changes in organizational roles, processes, and structure. The changes have not been minor. At Otis, the roles of branch managers and district and corporate executives were all affected. The need for as many levels of organization structure was questioned. Several processes allied to the maintenance process, such as engineering data gathering, also were effected. At Sun, organizational boundaries were pierced. As at Otis, Sun's system has caused more centralization of a major business process. Similar proposed changes in the major elements of the "modified Leavitt diagram" shown in Figure 1 can be traced in each of the other companies discussed in this paper and in almost all of the other organizations we studied.

These changes are so significant that the term "implementation" is too weak a word to apply to what takes place when systems such as these are integrated into the organization's functioning. John Henderson of our faculty prefers the word "transformation," for the third stage of project management noted in Figure 2, and he is right. When done correctly, with strong line direction (as at Otis, Norton, NEMC, and Sun), the result is a transformation which cuts across previously independant division, functions, or other organizational subunits and which affects aspects of most (if not all) of the organizational elements.
noted in Figure 1. This is why this step of the application development process must now belong to the line. Only line management has the power to initiate and execute an organizational transformation of any magnitude. And today's interfunctional and interorganizational systems can cause significant transformations.

A New Major Responsibility

What is the result of this emerging pattern of line direction of fourth era information technology applications? Quite simply, the line managers we interviewed feel that they have merely added another item to their list of significant responsibilities.

It can be argued that most managers have traditionally accepted three major responsibilities. First, they have always been responsible for the operations of their organization whether it be a corporation, division, function, or department. This may mean, for an accounts receivable supervisor, ensuring that the cash is collected. For a transportation manager, it means seeing to it that the trucks run on time and that deliveries are made. As one moves up from functions to divisions and to the organization as a whole, the "operations" job becomes one of managing lower level managers so that the organization's tasks are carried out.

In addition, it has been well recognized for decades that line managers have the ultimate responsibility for control of two major resources, money and people. Although corporate staff groups may assist the line in performing wisely in each area, there is little doubt where
the responsibility lies for the management of money and people in each suborganization. The responsibility of each line manager to manage so as to meet his expense budget and/or revenue goals (depending on whether the organization is a cost, profit or investment center) is clear. In like manner, each line manager is responsible for the deployment, development, and management of his human resources.

About three decades ago, an additional major responsibility was added to the agenda of each line manager (Figure 3). When, in the early 1960s, it became increasingly evident that "planning," beyond mere one-year budget projections, was vital to the organization, corporations first attempted to satisfy this need through a central planning staff devoted to long range and/or strategic planning. Unfortunately, this did not work. The need to have the planning process integrally connected to the reality of each line manager's competitive environment forced a shift of the primary planning responsibility from staff planners to the appropriate line managers. Today, in most major organizations, although in different ways, each line manager must perform all planning processes (annual, long range and strategic) to be certain that his major resources are utilized well to meet his goals.

Seen in this light, in 1987, as noted in Figure 3, an increasing number of line managers are taking on an additional responsibility -- that of actively exploiting their information technology resources. For some, proactive management of the information technology resource is as critical as effective management of other resources, if not more so.
Figure 3

Significant Line Management Responsibilities

Traditional
- Operations
- Financial Management
- Personnel Management

Added in the 1960's
- Long Range and Strategic Planning

Added in the 1980's
- Strategic Use of Information Technology
The Information Technology Managers Role Grows Also

Given the state of the technology, and many line managers' lack of expertise with this technology, the line cannot conceive and implement strategic uses of information technology by itself. In every case that we have seen, there has been some involvement in the conception and implementation of systems from the information systems (I/S) staff. This interaction, depending on the system, has ranged from simple education or consulting to extremely heavy involvement in translating ideas into implementable systems and in designing and assisting in the implementation process. For major new systems, a full and active partnership between the line and the systems group has most often been in evidence.

In fact, as the line role grows with regard to innovative systems, the role of the information systems group is also expanding, rather than diminishing as might be thought (Rockart and Benjamin, 1988). This is not a zero-sum game. The role of the senior information technology executive is a far more significant one today than ever in the past along four major dimensions (Figure 4). It is important to note here the reasons for this, lest this article convey the wrong impression.

First, with regard to system development, even those systems in which the line is heavily involved require greater competence and skills on the part of the I/S organization than ever before. To effectively play the "helping" role noted above, I/S personnel need significant knowledge of the business. Equally important, the technical design, programming, and operation of these business-critical, often highly complex, systems presents
Figure 4

THE INFORMATION SYSTEMS LEADERSHIP ROLE

Traditional Major I/S Functions

- Technical (sometimes business) design and programming
- Project management
- Operations
- Staff activities (consulting, planning, education, etc.)

Newly Critical Functions in the Late 80’s and 90’s

- Design and programming of increasingly complex “mission critical” systems
- Infrastructure development and maintainance (computers, network, software, data)
- Education of line management to their responsibilities
- Education of I/S management concerning the business
- Proactive use of business and technical knowledge to “seed” the line with innovative ideas concerning effective uses of information technology.
a far greater challenge than systems of the previous eras. Today's systems require data base, project management, telecommunications, and a host of other skills not previously demanded of I/S personnel.

Second, today's new systems require the development and implementation of a general, and eventually "seamless", information technology infrastructure (computers, telecommunications, software and data). The challenge to I/S management is to provide leadership for this profoundly vital set of "roads and highways" in the era of "wired society" cannot be understated. No one wants to pay for the overhead of roads and highways not currently needed for a specific business objective.

Third, there is a need to educate line management to its new responsibilities. The line executives noted above are an intentionally biased sample. Not many of them exist today. The need now is to get all line executives to take on this new role. This can only be done through education, both formal and informal, and sometimes only over an extended period of time.

Fourth and finally, I/S executives must educate themselves and their staffs to all the significant aspects of the business. Only if this is done will I/S personnel be able to knowledgeably assist line management in creating the systems which will be most useful in carrying out the organization strategy. And, only if this is done, will the senior I/S executive be able to "seed" the minds of line management with ideas concerning the most effective application of each new technology as it appears on the scene.
In short, the role of the information system executive has also expanded. He or she is today a business executive -- increasingly responsible for providing the line with not only the knowledge of the technology applicable to their businesses, but also with the technological tools and integrated infrastructure which can enable the rapid and efficient development and implementation of innovative business systems. The ingredients of this leadership role, as reflected in the four points above, have been clearly expressed by Ed Schefer, previously the senior information executive at General Foods. Prior to his promotion to a senior line position, Schefer noted that he spent one-third of his time running the I/S organization, one-third communicating with General Food executives (both learning from them about the business and educating them as to the technology), and one-third of his time external to General Foods -- learning about both advances in the technology and about business conditions in his industry.

Thus, not only do we see a significant "line leadership" role, but the I/S leadership role has also grown and expanded. With the increasing importance of information technology to industry today, this is far from surprising.
References


