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# Information As a Factor of Production

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## ABSTRACT

Information ... the special characteristics of it make it unique. The thrust of this paper advocates that information be added to the list of traditionally accepted factors of production. To accomplish this, comparative views of the factors of production as seen by the economist and manager are reviewed, the special nature of information is explored, and implications of adding information as a productive factor are discussed.

## INTRODUCTION

Given the importance of information in today's industries, it is critical that organizations not lag behind competitors in development and utilization of information resources. Often, it takes years of lead time to develop an efficient information resource. For a lagging competitor, the race is finished about the time this critical distinction sets in. Organizational information will not become less important. As more firms think competitively, attitudes toward information must change. Firms must think of information as a strategic asset — an asset that becomes the enabler of business plans.

Successful managers of the future are likely to be well-informed opportunists who use information strategically and have the flexibility to respond to opportunities. The important task for these managers will be to combine the right information with the right opportunities at the right time. This means that information will have to be looked upon differently — no longer thought of as simply a product of back room support activities.

Only within the last few years has the availability of information become such that managers have been able to obtain it when they need it. Although much information has to be sifted, key information that is timely and complete provides those managers that have it, and know how to use it, with leverage over competing firms not having similar information. But, so far, according to Bruns and McFarlan [2] only the most progressive companies have fully leveraged information over their competitor's distinctive advantages.

The availability of information and its accompanying technological processes have blossomed to the extent that it has generated strategic opportunities which all U.S. industries

should take advantage of if they want to maintain a competitive edge. To accomplish this on something other than a fortuitous basis requires an awareness that before information can be used effectively, managers must first recognize it as a strategic resource and as an important productive input.

Historically, many authors have contended that information — and its accompanying technology — be used as strategic tools. For example, Benjamin et al. [1] advises that many opportunities for strategic use of information exist, and more are constantly emerging with the increasing flow of lower cost technologies that provide significant new capabilities. Parsons [9] maintains that information technology has dramatically altered the structure of markets in many industries. He indicates that although many managers understand the potential impact of information on their firm's competitive position, others fail to consider the strategic implications of the firm's information resources.

As evidence of the opportunities for strategic use of information, Wiseman and MacMillan [12] purport that as the pace of competition intensifies, information will emerge as a critical weapon in the battle to gain an advantage over competitors. Supporting this contention, Edwards [5] suggests, "...successful organizations will be the ones which manage information most effectively."

McFarlan [7] raises another opportunity for the strategic use of information by noting that information technology is moving from a strictly supporting role to an important resource which can throw a firm's competitors off balance. Further, firms that are able to synchronize their information resources with their business strategy tend to be more successful than those who do not. For example, a study by Feldon [6]

indicates that organizations with "...formal business and system plans and programs to plan, organize, monitor, and control the(ir) information resources outperformed (other firms) by 300 percent." Feldon also underscores the fact that firms effectively utilizing their information resources can leverage other factors of production to financially outperform other companies.

As we move toward a more global economy, it follows that the value of information would become more significant in the international arena as well. In fact, Diebold [4] suggests that the information resource is not only a determinant of international competitiveness too. Vincent [11] also indicates that in an internationally competitive environment, an important challenge for U.S. companies will be to optimize the value of their information. By so doing, these firms will realize productivity gains, thus sustaining a competitive edge.

To best take advantage of the opportunities for the strategic use of information, Marchand and Horton [8] suggest that a company should adopt strategies for competitive advantages that maximize the use of information resources already contained in the firm. Using this approach, information resources already available can be used by aggressive managers to facilitate product designs and development; to improve the quality or flexibility of operations and production; to streamline or re-orient marketing approaches; to assist in monitoring sales or improving customer satisfaction; and, to provide greater control over costs.

Information assets may be used more strategically inside a firm by supporting whatever business objectives the firm pursues. Thus, utilizing proprietary information as a strategic resource is prudent — if not imperative — in view of today's competitive pressures.

## INFORMATION AS A FACTOR OF PRODUCTION

Incorporating information as a strategic corporate asset means managing a dynamic balance between the conceptual thinking of economists and managers. Economists have generally grouped productive factors into three broad categories: land, labor and capital. These factors have been viewed as the necessary inputs to any productive process. Land has been used to represent the input of raw materials; labor the efforts of man; and capital the input of money into the process. These inputs, or factors of production, have generally been viewed as substitutes for one another, at some diminishing rate. Thus, the use of labor could be increased and substituted for inputs of capital or land. Due to the scarcity of these inputs, however, a continual increase in the amount of labor applied to a productive process (while land and capital remain fixed) would result in less and less output per unit of labor added. Even if labor were extremely cheap, diminishing returns would eventually be reached where further increases in output could only be obtained by increasing the input quantities of

land and/or capital.

A primary concern of theoretical economists and practicing managers is the *optimal* allocation of resources under their control. The economist is concerned with producing the highest possible level of utility given the productive resources available. This translates into using the firm's factor endowments in the most efficient way possible — finding the best fit of input combinations to accomplish the productive task.

Management theorists have extended the list of factors of production that was originated by economists. Many management scholars subscribe to the ideas of Frederick W. Taylor [10]. That is, they accept the proposition that management makes a unique contribution to the productive process. As a result, they include management talent and entrepreneurial ability as factors of production. These additional factors are usually defined in terms of the professional managerial skills and the necessary risk-taking that is involved with innovation and ownership of a successful business enterprise. Thus, managers would list land, labor, capital, management and entrepreneurial ability as the factors under their control.

It is the authors' contention that the time has come to add another factor of production — *information*. The inclusion of information as a productive input should not entail as great a conceptual leap for managers as for economists. As land, labor, and capital are all tangible inputs, it is easy for both economists and managers to recognize their value to the productive process. Management and entrepreneurial ability are far less tangible and are, therefore, more difficult to evaluate. But, because managers have already accepted management and entrepreneurial ability (relatively intangible factors), they should now be open to the concept of adding information as a productive input. Information, however, possesses special characteristics that make it unique.

## THE SPECIAL NATURE OF INFORMATION

As a factor of production, information is unlike any of the other factors in many important aspects. These differences cause the need for decision-makers to re-evaluate the way in which productive factors are combined to produce goods and services. There may also be an impact on those that own the other factors of production, for the way in which the other inputs are allocated may be greatly altered.

The salient characteristics of information were outlined by Cleveland [3] and expanded upon by the authors. Cleveland purports that information is expansible, compressible, substitutional, transportable, diffusive, and shareable.

### Information is Expansible

Most information tends to expand with use. Thus, as information is used — even more is generated. On the surface this attribute may seem to be of little consequence. However,

when the idea is applied to the efficient use of productive inputs, the revolutionary nature of information as a factor of production may be seen. All of the other factors of production are viewed as being scarce — that is, there is greater demand than supply of these inputs. If information expands with use, it must not be viewed as being a scarce input, but rather an input of potential glut!

The only limits on the use of information would be the capacity of users to analyze, store and retrieve it. But, even the limitation of analytical ability may diminish as artificial intelligence is further developed. The non-scarce nature of information must bring about a rethinking of the calculus of utility maximization or cost minimization.

### **Information is Compressible**

It is possible to concentrate, integrate, or summarize, vast amounts of information for easier handling. Through the selection and compression of information into knowledge and wisdom, some of it is necessarily lost. The compression process, while necessary, is also a potential source of error — eliminating information which may be needed. Managers must familiarize themselves as to the value of their information holdings (as they know the worth of their tangible assets) in order to be able to distinguish the important from the trivial and preserve that which is needed.

### **Information is Substitutional**

The evolution of mental processes which leads managers to think of information as a factor of production, must also cause them to grasp the idea that information can be substituted for land, labor, capital, entrepreneurial ability and management. In many cases, managers will come to the realization that information can be substituted for other, more expensive, and less substitutional, factors of production. For instance, when other resources are used more efficiently (i.e., less of the resource is used, due to the use of new information), the net result is a substitution of information for the more efficiently used resource in the productive process.

### **Information is Transportable**

Using telecommunications technology, information can be transported at the speed of light! Thus, it provides a lightning response time for decisions. Also, information movement can be a strategic competitive tool in that its ease of movement does well what physical distribution does poorly. With information, managers are not faced with the problem of physical transportability associated with the other factors of production. While some cost is involved in the “transportation” of information, its speed and lack of physical bulk should keep this cost relatively low.

### **Information is Diffusive**

Information tends to leak. It is difficult to contain information as one would think of containing a physical thing. Because information lends itself to diffusion; secrecy, property rights, and confidentiality, are called into question. Yet, because information is easily “transported,” potential authorized users can have ready access to it. At the same time, processes can be established to deny, or limit, its pilferage. That is, ways should be found to secure it in much the same manner as the other factors of production without overly restricting the legitimate “transportation” of information.

### **Information is Shareable**

The premise that information can be easily shared should cause a change in managerial thought. With information, managers must not think in terms of traditional exchange transactions, where one party gives up something of value in exchange for something else of value. Information is shareable. That is, I may give information to you without losing it myself. If information is shared — we both have it! My stock is not diminished because yours is increased. In fact, the same information can be sold or exchanged again.

## **IMPLICATIONS**

A major implication of adding information to the combination of productive inputs may be that “things” will be partially diminished as the dominant factors of production. Managers must adjust to this new way of thinking, and recognize that information is an important productive input and a potential saleable output of the organization.

Managers will also have to reconsider the nature of the managerial process. Thinking of information as a peripheral activity, often relegated to a staff slot in the back room, is no longer viable. Information gathering, processing, and dissemination is fact becoming a key activity of many organizations. The more traditional functional activities such as finance, marketing, and manufacturing, are shifting in importance as our information-based society grows.

The cloistered nature of the information function is certainly fading as it is being reshaped by both user needs and corporate realities. In this context, greater strides must be made in establishing uniform protocols allowing for the total integration of information into the organizational structure. The past privileged status and attendant mobility of “computer experts” is proving perishable with the explosion of information technology and the computer literacy of more and more managers. Out of necessity, information managers will have to move toward a way of thinking which places them more in tune with the reality of a new organization structure. The day may be fast approaching when managers will not place control of a valuable corporate information asset in the

hands of a "computer expert" who may have little knowledge or understanding of the business operations of the organization. This is not an easy change. It necessitates a remodeling of the firm, one that is vastly different from the conceptual model of today. Bruns and McFarlan [2] indicate that because information is organizationally neutral it does not favor one organizational structure over another — it simply means that information offers top management choices they have not had before.

The implications of adding information to the traditional list of factors of production go far beyond those discussed above. Some implications can raise intriguing questions. For example, it information can supplant the other factors, what will happen to the value of the other factors? If their demand is lessened, their worth as productive assets is likely to be cheapened. Since the United States is considerably more endowed with generous amounts of land, labor, capital, management and entrepreneurship than many other nations — yet, is on par with, or perhaps behind, many of them in terms of information resources — will she find herself weakened in head-to-head world market competition?

At the expense of adding information as a factor of production, smart American managers will strive not to permit a decrease in the value of the other productive assets. These managers will weave information into the fabric of their production function with a likely symbiotic result — where all the factors, including information, collectively operate to produce more efficiently. Greater efficiency also fits with the economic ideal of producing at the point of utility maximization.

## CONCLUSIONS

It is important that information be recognized as a factor of production along with land, labor, capital, management and entrepreneurial ability. Some changes in managerial thinking are called for. Any dislocations, however, can be minimized through planning and adjustment of conceptual models to take into account the increasingly important role of organizational information.

Based on a recognition of information as a major factor of production, managers at all organizational levels — but under the impetus of top management — must formulate and implement new organizational models which recognizes the implications and the unique characteristics of information: expansibility, compressibility, substitutability, and transportability, as well as its diffusive nature and shareability.

This mental revolution, not at all unlike that which was called for by Frederick Taylor [10] when he proposed that management should be viewed as a separate factor of production early in the twentieth century, should result in a new way of thinking about the nature of organizations and the purposes which they serve in the economy and in society as a whole.

Furthermore, this new strategic vision about the role of information must be made part of the fabric of the organization and not just a passing fancy.

The economic gap between those that possess and employ information resources effectively, and those who do not, will likely widen appreciably in the 1990s. Only those managers who best understand this impact and direct their organizational resources in such a way as to best utilize information as a productive asset are likely to survive in an increasingly competitive environment.

Those firms recognizing the fact that information is a salient productive factor growing in importance — and taking action to alter their conceptual models — will be in the best position to take advantage of potential opportunities that are a by-product of this change. Seizing the opportunity of renewing themselves, these firms are likely to prosper, leading the way into the 21st century.

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