Research

Using Information and Information Technology for Sustainable Competitive Advantage: Some Empirical Evidence

William R. Ring
Joseph M. Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA 15260, USA

Varun Grover
Joseph M. Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA 15260, USA

Ellen H. Hufnagel
College of Business Administration, University of South Florida, Tampa, FL 33620, USA

In the anecdotal literature on the strategic use of information resources, the notions of information and information technology are often used interchangeably. This paper emphasizes the importance of distinguishing between these two types of information resources to enable the identification and development of strategic applications. Empirical evidence based on a survey of 84 US firms indicates that the profiles of application of the two resources are indeed quite different. The survey results also suggest key organizational factors that may inhibit or facilitate effective exploitation of these information resources.

Keywords: Information resources, Competitive advantage, Strategic information systems, Organizational inhibitors, Organizational facilitators.

Introduction

The notions of using information resources for “strategic advantage” or as “competitive weapons” have now become commonplace [7,10,12,13,14,21]. Unfortunately, while these notions are potentially both important and powerful, they are also imprecise and unstructured. Most of the literature in the area continues to be anecdotal, and the remainder is primarily prescriptive. There is little evidence of an accepted or validated theoretical framework or structure for applying the ideas and there is even less in the way of empirical evidence concerning the validity and utility of these notions [23].

This paper assesses some of the fundamental issues surrounding the notion of information and technology as a strategic resource, focusing on a

Varun Grover is a candidate for a Ph.D. degree in information systems at the University of Pittsburgh. He holds a Bachelors degree in electrical engineering from the Indian Institute of Technology, New Delhi, and an MBA from Southern Illinois University. His research interests include strategic information systems, telecommunications management and MIS politics. He has authored articles in Decision Sciences, Information and Management, and others.

Ellen Hufnagel recently received her Ph.D. in MIS from the Katz Graduate School of Business at the University of Pittsburgh and is a faculty member at the University of South Florida.

William R. King is University Professor in the Katz Graduate School of Business at the University of Pittsburgh. He is President-Elect of the Institute of Management Sciences and was Senior Editor of the MIS Quarterly. He is the author of more than a dozen books and 150 papers that have appeared in the leading journals in the fields of information systems, management science and strategic planning.
key distinction that may prove to be important in making these concepts operational and useful. In particular, its objectives are:

- to highlight factors that distinguish the two key varieties of information resources: information and information technology
- to present empirical data on the actual strategic business applications that have been made and the organizational factors that serve to facilitate and inhibit the development of such applications.

The distinction between information technology and information are important, because a recognition of the differences between the two varieties of information resources enable a firm: to focus attention on opportunities involving both kinds of resources during planning and decision making processes; to provide the different kinds of support that are appropriate to the development and implementation of the two varieties of resources; and to understand the factors that may differentially facilitate or inhibit their development.

The empirical evidence concerning what is actually being done by U.S. firms is used to validate and to illustrate this distinction, as well as to suggest processes and organizational factors that may be more effective in developing strategic applications of information resources.

Information Resources: Information Versus Information Technology

One thing that can be inferred from the anecdotes in the literature concerning the strategic uses of information resources is that information and information technology are often discussed interchangeably. “Information technology” is a resource that is fairly well defined and readily measurable – in terms of the number, memory capacity, transmission speed, processing capacity, etc. of computer-based systems. “Information” is a quite different resource – one that is less well understood and much more difficult to measure [1,16]. It is important to make the distinction between these two types of resources as clearly and explicitly as possible, because there is every reason to believe that the potential strategic applications of information technology may be quite different from the potential strategic uses of information.

The following “working” definitions of these two types of information resources will help to clarify this distinction.

*Information technology* is defined by Bakopoulos [2] as “the set of non-human resources dedicated to the storage, processing and communication of information, and the way in which these resources are organized into a system capable of performing a set of tasks”. Thus, technology includes both the hardware components that make up the information system architecture and the systems software that enables it to function as an integrated whole. *Information*, according to MacKay [18], refers to “that which enables us to make a selection from a set of possibilities or to narrow the range of possibilities about which we are ignorant.” Thus, information can be thought of as data that has been evaluated in such a way that it alters our expectations or our view of the alternatives that are available. Here, it also refers to the analytic software that facilitates this use of data.

*Information Technology as a Source of Value*

This notion of information technology focuses attention on the “devices” that are used in the information handling process, including the software that controls and monitors hardware operations. The hardware component encompasses not only computers, terminals, microprocessors and communication lines, but also more traditional office equipment such as telephones, typewriters, and dictaphones. The software component includes built-in logic, operating systems, and any other software that facilitates the movement or storage of data without concern for its specific content or use. Thus, information technology can be considered in much the same way as we think of production technology – it is the equipment and ancillary resources which convert or combine basic raw material inputs to produce a new product, adding new value in the process.

The information technology asset invariably *depreciates* in worth over time. As new technology becomes available, needs change, and physical deterioration occurs, such assets come to be worth less because their potential for adding value is relatively low.
Information as a Source of Value

The notion of “information” shifts the focus away from information processing, and the value added by the physical equipment and systems software, to the information itself – the raw material on which these tools operate as well as the decision-support analytic software that transforms the data into information. It forces us to take a step backward in the value chain, to consider the informational assets that are at the firm’s disposal. How can the stores of data collected by existing systems be put to new uses to create value in important ways?

Just as raw materials can constitute input to various production processes, data – the raw material for information – can be used in various ways. By altering the way in which existing data are evaluated or aggregated, the dimensionality or structural content of the information may be altered to provide a different input to a different level of decision-making. While some type of information technology is usually required to perform the evaluation or filtering function, adding value through increased timeliness or presentation format, a focus on the content of the information system – the information – can suggest new opportunities that are not evident when the sole focus is on the technology.

Unlike information technology, which invariably depreciates with use and over time, information can appreciate in value. As information is used, it can become more valuable as more potential uses are realized and its deeper meaning is better understood by the humans who use it.

Creating Value with Information Technology and Information

Most discussions of the potential contribution of information resources to corporate strategy have emphasized the technology and paid little attention to the information itself. However, given the fundamental differences between information and information technology, we might anticipate that the ways in which information technology can be strategically used may be quite different from the ways in which information can.

For example, one company that has taken advantage of technological advances in computing to provide a new way of relating to its customers is American Hospital Supply (AHS). AHS determined that relations with its customers could be strengthened by placing terminals in each customer location to allow for easier order placement, as well as to provide a means of advance price and availability checking. While this information was previously made available to customers by phone on request, it is now provided instantly via communication links. Customers are thereby “tied into” AHS in a way that makes it more difficult and less attractive for them to change suppliers. In this case, information technology was the key factor in achieving improved customer relations and/or competitive advantage.

Of course, some attributes of the ordering information have been changed. Information is available in a more timely fashion and may be more accurate when processed through an integrated computer-based system. However, the key factor in the AHS strategic use of information resources is the information technology. The information remains much the same as it was under an older, paper, order-based system.

Other companies have used information itself as a key resource to support overall business strategy. For instance, Lee Iacocca described how Chrysler used a database on suppliers and dealership locations to convince members of Congress to support loans which ultimately saved Chrysler [8]. In doing so, Chrysler used available information in a new way to alter Congressional views of the choices available and to thus ensure the continued existence of the company. Although computer technology facilitated the processing of this information, it was not the technology that provided the key strategic support, but rather the information.

Thus, the primary distinction between strategic applications these two varieties of information resources lies in the source of the value added. In the case of AHS, the introduction of technology increased the value of existing information by providing easier access or speeding up transfer time. For Chrysler, the information provided strategic support through the new use to which it was put.

Of course, information technology and information can be employed together to create competitive advantage. This occurs, for example, when an airline, which has already pursued the use of information technology by putting computer reservation terminals into travel agencies and operating its reservation system to achieve competitive
advantage in the marketplace, begins to use the
detailed information on supply and demand for
various routes to compete more effectively by
managing the availability of discount-priced seats
on its flights. This ensures that it will more effec-
tively capture a greater proportion of business
travelers’ demand for full-price unrestricted tickets
and at the same time fill otherwise empty seats via
reduced-price tickets that are sold with restrictions
on timing, penalties for changing reservations, etc.
Thus, the airline has used both information technol-
ogy (the terminals in the agents’ offices and the
associated software) and information (the
supply-demand data for various routes) to gain
competitive advantage.

It may be argued that the uses of information
technology and information to achieve competi-
tive advantage are often interdependent. For in-
stance, in the airline example, the competitive use
of the technology was a necessary precursor to
competitive use of the information. However, if
the same information had been available through
some means other than the proprietary reservation
system, the same competitive use could have been
made of it. This situation actually exists since
some airline reservation systems generate ad-
ditional revenues through sales of supply-demand
data to other airlines. For the purchaser, this informa-
tion has potential competitive value even
though it did not first seek advantage through the
development of the information technology that
produces the information.

As these examples illustrate, information tech-
ology and information can provide new sources
of strategic support, either separately or together.
In the very common situation where the scope of
the search for strategic advantage through informa-
tion resources is limited to options that involve
only information technology, a firm is displaying a
kind of “information myopia,” an error of analy-
sis whereby available information resources are
defined so narrowly that some key strategic op-
portunities are missed. Furthermore, it is possible
that the processes that may be most effectively
employed to identify such opportunities and the
organizational factors that facilitate or inhibit
these processes are quite different.

The important point is that, because of our
failure to draw careful distinctions between stra-
tegic uses of information technology and informa-
tion, we may have stifled efforts to develop practi-
cal planning and decision making processes that
facilitate the identification and development of
strategic information resource applications. Since
information technology and information are dif-
ferent, it may be that the two entities should be
considered and dealt with separately if good re-
results are to be achieved. When managers in a firm
attempt to identify alternative strategic uses of
information resources, ideas that relate primarily
to information technology will usually emerge first
and most prolifically because it is easier to visual-
ize and deal with these tangibles. The less clearly
defined information resource will be pushed into
the background when, in fact, it may have the
greater potential for producing benefits. So, it is
important to make the distinction, if only because
it helps us to think in different terms, with differ-
ent models, processes, and expectations about the
two types of information resources.

**Empirical Evidence Validating Distinction**

A recent survey of 84 information managers
sought to determine the extent to which informa-
tion and information technology are being dif-
ferentially utilized in the pursuit of strategic objec-
tives and to identify the business contexts in which
this was being done. The information managers
responded to a survey that was sent to 414 mem-
bers of the Society for Information Management
(SIM) whose job title (as listed in SIM files)
indicated that they held an executive position in
IS – e.g., Vice President of Information Services,
IS Director, etc. The 20.3% response rate is about
that generally anticipated from such a survey.

Respondents were asked whether or not their
firms had made strategic use of each of the two
varieties of information resources – information
technology and information – in the following
areas derived from Porter [20]:

- supplier relations
- customer service
- product service differentiation
- new product planning
- cost competitiveness
- market segmentation

Respondents were asked to identify and describe
the systems or applications that provided the basis
for any positive responses.
The survey instrument was carefully developed and pretested to ensure that the distinction between information technology and information was understood by the respondent. Examples of both varieties of strategic applications were provided as a part of the instrument. The success that was achieved is illustrated by numerous requests to the authors for permission to use the survey instrument as a basis for educating managers in respondent firms.

One purpose of this survey was to validate the distinction. If, in fact, there are substantial differences in the profiles of applications in the two categories, it may be quite meaningful to make this distinction. Table 1 shows the profiles of strategic applications for information technology and information respectively.

Of the 84 managers responding, 95% indicated that their firms were using information technology to achieve strategic benefits. Over 64% of the respondents claimed to have installed applications in the area of customer service and more than 66% claimed applications in cost competitiveness. Surprisingly, only slightly more than 28% claimed applications in supplier relations, which is often touted as a major area of opportunity for using information technologies, such as electronic data interchange (EDI).

Approximately 86% of the respondents indicated that their firms had developed strategic information-based applications, with the largest proportion of positive responses (64%) also being in the area of customer service. However, only 39% claimed applications of information in the area of cost competitiveness (compared with almost 67% for such application of information technology) and over 52% had applied information to market segmentation.

So, while the primary application of both information technology and information is to customer service, the overall profile of such applications is quite different for the two varieties of information resources. These results suggest that the distinction between strategic uses of information and of information technology is not only a potentially important one, but is one that information managers themselves recognize.

The Ability to Exploit Information Resources

Firms obviously differ in their ability to exploit information resources, and competitive advantage is contingent on these differences [4]. Whether it be an information technology or an information based application, the firm must recognize that it may have exploitable assets. Furthermore, it is only after a reconciliation of such organizational facilitators (factors that positively influence the ability to exploit information resources) and inhibitors (detriments to the firm’s ability to exploit information resources), within the context of the firm’s strategy, that a defendable, long-term strategic application can emerge.

Among the specific organizational factors which might facilitate an organization’s ability to use information resources are technological factors, such as the existence of extensive computing facilities, a strong technical support staff, and an existing technology leadership position relative to the industry as a whole. Firms that have such resources at their disposal and recognize them as valuable assets may gain a competitive edge by deploying them in support of business strategy. Similarly, a firm might take advantage of more macro-level characteristics, such as its already
strong market or financial position and the information resources that have been developed to support that position, to further increase its competitive strength.

On the other hand, recognition of organizational characteristics that inhibit strategic application development is also crucial. Deficiencies in the planning process, lack of clearly defined development priorities, and insufficient management support for strategic application development efforts can seldom be overcome if they have not been explicitly identified as impediments to successful strategy implementation.

In our survey of 84 companies, respondents who had identified their strategic applications of information technology and information were also asked to evaluate a list of potential facilitators and inhibitors. Thirteen possible inhibitors and ten possible facilitators were provided, and respondents were asked to rate each of them on a 5-point scale.

The average score for each of the inhibitors is shown in Table 2. The relative importance of information resources as a strategic priority, the lack of appropriate planning, the lack of top management support, and the difficulty in assessing tangible contributions stood out as major inhibitors. Thus, it is obvious that more remains to be done in integrating strategic information-based considerations into the strategic milieu of the organization.

With respect to the facilitators shown in Table 3, strong technical support and expertise, the leadership position in information technology, competitive pressure, financial position, and extensive computer facilities were rated as the most important. Thus, the existence of appropriate resources and competitive pressures appear to be the strongest.

### Conclusion

The main objective of this paper has been to stimulate thinking with regard to the types of information resources – information technology and information – that are at the firm’s disposal and the ways in which they are being employed to create competitive advantage. Data gathered from 84 companies provides preliminary validation for these distinctions and suggests avenues for more detailed study. The distinction between information and information technology has been discussed primarily in terms of the source of the “value added.” Recognition of this distinction is important to facilitate planning and development of strategic applications which capitalize on both varieties of information resources.

The areas in which strategic applications have been made are also of importance in suggesting opportunities for the strategic use of information resources. “Supplier relations” stands out as a specific area of opportunity for the strategic application of information technology.

The identified organizational facilitators and inhibitors suggest that existing expertise in information systems technology is of critical importance to the applications that have been devel-

### Table 2
Organizational Inhibitors Mean (std. dev.) (1 – Not Inhibiting, 5 – Greatly Inhibiting).

<table>
<thead>
<tr>
<th>Inhibitor</th>
<th>Mean (std. dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of Appropriate Planning</td>
<td>3.31 (1.27)</td>
</tr>
<tr>
<td>Low Perceived Importance of Concept</td>
<td>3.10 (1.26)</td>
</tr>
<tr>
<td>Lack of Appropriate Technical Support Staff</td>
<td>2.30 (1.24)</td>
</tr>
<tr>
<td>Budgetary Constraints</td>
<td>3.04 (1.16)</td>
</tr>
<tr>
<td>Difficulty in Assessing Tangible Contribution</td>
<td>3.43 (1.02)</td>
</tr>
<tr>
<td>Complexity of the Concept</td>
<td>2.86 (1.10)</td>
</tr>
<tr>
<td>High Potential Start-up Difficulties</td>
<td>2.79 (1.04)</td>
</tr>
<tr>
<td>Lack of Organizational/Top Management Support</td>
<td>3.25 (1.33)</td>
</tr>
<tr>
<td>High Potential Start-up Difficulties</td>
<td>2.95 (1.50)</td>
</tr>
<tr>
<td>Nature of External Environment or Industry</td>
<td>2.75 (1.26)</td>
</tr>
<tr>
<td>Ill-Defined Management Objectives</td>
<td>2.89 (1.19)</td>
</tr>
<tr>
<td>Other Priorities (are more important)</td>
<td>3.59 (1.08)</td>
</tr>
<tr>
<td>Other</td>
<td>4.75 (0.46)</td>
</tr>
</tbody>
</table>

### Table 3
Organizational Facilitators Mean (std. dev.) (1 – Not facilitating, 5 – Greatly facilitating).

<table>
<thead>
<tr>
<th>Facilitator</th>
<th>Mean (std. dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong Market Position of the Firm</td>
<td>2.95 (1.40)</td>
</tr>
<tr>
<td>Existing Information Technology</td>
<td>3.17 (1.28)</td>
</tr>
<tr>
<td>Leadership Position</td>
<td>2.38 (1.12)</td>
</tr>
<tr>
<td>Extensive Computer Facilities within the Firm</td>
<td>3.22 (1.25)</td>
</tr>
<tr>
<td>Strong Organizational/Top Management Pressure from Competition</td>
<td>2.69 (1.29)</td>
</tr>
<tr>
<td>Strong Technical Support/Expertise within the Firm</td>
<td>3.15 (1.23)</td>
</tr>
<tr>
<td>Strong Financial Position of the Firm</td>
<td>3.40 (1.07)</td>
</tr>
<tr>
<td>Need for Uniqueness or Innovation</td>
<td>3.13 (1.28)</td>
</tr>
<tr>
<td>Other</td>
<td>2.67 (1.22)</td>
</tr>
<tr>
<td>Other</td>
<td>4.25 (0.96)</td>
</tr>
</tbody>
</table>
opcd. They indicate that lack of appropriate organizational support and processes have been important inhibitors in developing such applications. This too suggests how business firms might better develop strategic applications.

References


