Research

Information Systems for Sustainable Competitive Advantage

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There has been an increase in the attention paid to the strategic potential of information systems and a new willingness to accept the possibility that information systems can be the source of strategic gains. This belief is reflected in a host of publications, from the popular press to respected journals. Much of this has been supported by a very limited set of prominent and well publicized success stories, principally involving marketing and distribution, financial services, and the airlines.

Unfortunately, there has been little attempt at an analysis that abstracts from these experiences to determine factors that determine strategic success. This can be attributed in part to the absence of attention paid to unsuccessful ventures in the use of information technology for competitive advantage.

Although this paper relies on the same anecdotes, it augments them with data on a few unsuccessful attempts to exploit information technology and with economic theory where appropriate. General conditions that appear necessary for sustainable competitive advantage are developed.

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1. Introduction

There has recently been an increase in interest in the strategic potential of information technology. The popular business press has been featuring articles on information power [4] and on electronic distribution systems that keep customers "happy captives" [9]. Academic journals publish papers on information technology and its effects on competitive position [1,2,6,8]; textbooks are now available [14]. Conferences and executive short courses are also provided. At professional association meetings, discussions range from fixing COBOL payroll programs for sustainable competitive advantage, through 212 strategic ideas from a two day brain-storming session, to *premeditated electronic corporate murder* – how a firm can use information technology to bankrupt and to acquire a less agile competitor. IS directors, once treated as unavoidable administrative burden, now find themselves as material witnesses in antitrust cases.

2. The Need to Know More

What does this mean? Surely much is media hype or a current business fad. There is now a large, and largely anecdotal, literature, most of it referencing familiar stories of technologically directed competitive triumphs. How much do we understand? To what extent can we duplicate successes, find critical opportunities, or even predict the effect of new ventures? How many of the stories are true, or accurately reported? Much of this attention is justified – information systems *can* alter a product, *can* strengthen a firm's market position, and *can* radically restructure the market by altering relationships with suppliers or

customers. What does the director of MIS need to know about this? How can a company and its MIS director benefit?

A few initial observations are in order. *Firstly*, the phenomenon it real. A limited number of striking and well publicized successes have shown the potential of well crafted uses of information systems.

A major supplier to retail pharmacies has an order entry system that has provided significant benefits to customers, and, it is believed, significant advantage to the supplier. Customers can walk through their pharmacies with a bar code reader and a cassette recorder, scanning shelf stock; the cassette is then inserted into a special reader, the supplier is automatically dialed, and items needed and their reorder quantities are determined by computer. The order is shipped, prepriced, and laid out to correspond to the pharmacy's floor plan, so that it can be unpacked with a single run through the store; it generally arrives the next day. This reduces the effort needed to run the pharmacy and almost eliminates the need to maintain safety stocks [3,5].

Two leading airlines have reservation systems that are used by the majority of U.S. travel agents. These systems have been very effective in controlling the industry's *distribution channels*: a majority of airline tickets are sold through travel agencies, and of these a large majority are booked from the first screen displayed when flight information is requested. Screen position is thus critical: by listing their own flights first the host airlines biased or tilted reservations in their favor. Dropping a small competitor from the system could be devastating. Such blatant bias is now illegal. However, hosts have begun charging for listings, for ticketing, and for all reservations made through their systems; these systems are so necessary to competitors that ROI for computer reservation systems has been substantially greater than for operating aircraft. Whether or not airlines have ever exploited their ability to gain marketing information of their competitors through their reservation systems, there is little doubt of the benefits they have received through real time marketing information concerning their own flights; this has been particularly valuable in judging market response when new competitive fares are offered. In fact, these systems have been so successful that they have been the subject of lawsuits and FAA hearings.

Secondly, most of the successes have been accidents: they were in response to a real and pressing need of line management, but their strategic significance was not initially recognized. The most publicized customer-operated order entry system was developed not as a tool for tilting the market, but as a response to a shortage of order entry personnel. The airline reservation systems were originally intended as industry-wide consortia, but the first developers were unable to interest competitors in sharing the development and the expense. Accidents make very good copy, but are a dreadful way to create business strategy.

3. Generic Business Strategies

Michael Porter [11,12] presents three generic competitive strategies; these, he believes, form the basis of any successful specific business strategy:

- A *differentiated* strategy relies on providing superior value. Its products are difficult to imitate, difficult to replace with substitutes, and command premium prices.
- The *cost leader* enjoys a lower cost structure, which enables competition on the basis of price.
- The *focused* niche player finds a small specialty market in which to operate; a niche may be protected by geographic isolation, by historically tight working relationships between buyer and seller, or by a market too small to attract serious competitors.

In our experience, recent deregulation has changed the nature of geographically protected operations. Some small, artificially protected niche players have been devastated; other players have entered new markets and are thriving. Apparently, this change and uncertainty will continue.

4. Information Systems and Business Strategy – Conditions for Sustainable Advantage

Not all innovative uses of information technology are equally successful in producing real, sustainable benefits for their developers. Some, like Merrill Lynch's Cash Management Accounts or the two major airline reservation systems, are widely copied but have successfully defended market share against competitors. Others, like Automatic Teller Machines in banking, are almost

universally available and have produced no measurable benefits for most early providers. Some, like electronic home banking, have been almost totally ignored by potential customers. It is estimated that a major New York bank spent over $10,000,000 developing its home banking product, which has so far yielded less than 20,000 users, and almost no interest from other banks. Some innovations are widely copied but their benefits can be defended; others are copied with no strategic gains for any player; still others are ignored in the marketplace.

Merrill introduced CMAs when passbook accounts were still paying 5-1/4 percent, inflation was almost twice that, and prime was double digit and heading for 20 percent. CMAs were a very attractive new financial instrument, roll-out and advertising were well orchestrated, and the marketplace responded immediately. In very short order, hundreds of thousands of accounts, and billions of dollars, were attracted to Merrill. For technical and organizational reasons, competitors were slow to respond. And there has been a considerable amount of *account stickiness*. Although CMAs have been available now for over seven years, Merrill still enjoys over a 50 percent market share, well in excess of its nearest competitor.

ATMs offer considerable convenience to retail banking customers – 24 hour access to information about their accounts and to their money. This is no doubt useful and attractive, but it has not been nearly as attractive as offering to triple their interest. Initially, customers were concerned about the accuracy and security of ATM transactions; initially, these concerns may have been well founded. In consequence, customer adoption of ATMs, while now significant, was not rapid: in the six or seven years that ATM have been available in almost all metropolitan areas, the adoption rate has climbed only to about one third of retail banking customers. This means that in most areas late-comers, banks that were not innovators in the introduction of ATMs, were not closed out. Moreover, banks that were not at the forefront of ATM introduction generally benefited from the availability of hardware and from the experience of their bolder competitors; they generally enjoyed lower costs as a result.

Electronic home banking has generally been ignored by retail banking customers, probably because of its very modest benefits: a customer in need of cash must still visit the bank and deal with a teller or use an ATM. At present, home banking offers benefits to the bank, but little to banking customers. This does not mean that home banking cannot succeed if properly redesigned with real customer benefits. Home banking may in fact prove to be a service delivery mechanism for the 90s. However, adoption by retail customers will not be rapid, and banks will have time to respond.

We must characterize those uses of information technology that have offered, or will prove to offer, sustainable advantage. The first distinction is between *internally* and *externally* focused applications. The former are generally used within a firm, for cost reductions or quality improvements; they do not have interfaces with suppliers, customers, or the outside world. The latter are used principally by customers, clients, or suppliers, and should add value.

4.1. Externally Focused Applications

Externally focused applications have received much press coverage. By their very nature they are visible. When they work, they are dramatic. Successful innovations here are characterized by the following:

- There is real benefit to the customer, to bring him in – value added
- There is real benefit to the firm – growth in market share, increasing profit margins
- There is time for the innovator to harvest the benefit

The value added by an externally focused information system can be of many forms. In the case of most customer support systems, and in almost all systems aimed at supporting marketing and distribution, a principal element is reduced customer *transaction costs* – those costs associated with executing the transaction itself, and not with the goods or services being purchased. These costs may be managerial time, shipping costs, or costs due to uncertainty in delivery time or product quality [13]. In the case of the drug distributor, reducing transaction costs includes ease of placing the order, ease and speed in restocking the shelves, and reduced uncertainty in lead time and hence inventory holding costs. In other instances, reduced or eliminated safety stocks offer all the benefits promised by just-in-time delivery. In the case of travel agents using computerized reservation sys-

tems, reduced transaction costs included speed of reaching the airline; the ability to reach all airlines' reservation systems through a single interface; and reduced uncertainty due to real time booking of flights. Other benefits often include increased customer control, better and more rapid information essential for customers' planning, increased customer satisfaction, and the intangible benefits from a constant, reassuring, electronic presence. Value added for the customer is essential: it attracts the customer.

There are two sources of benefits to the firm: increased profit margins and increased market share. Margin benefits come from reduced internal costs, or from increased customer prices justified by higher value added. Not surprisingly, to be successful the system's benefits must be consistent with the firm's strategy. If the firm's competitive strategy is based on cost leadership, and operations, management, and R&D are predicated on this strategy, it makes little or no sense to develop an application whose benefits are based on increasing prices. A very simple example should suffice to illustrate this point: Mercedes and Volvo have recently introduced 24 hour emergency roadside service and have featured it prominently in their national advertising; a similar campaign would probably be counterproductive for manufacturers of the lowest price cars.

The final point – time to harvest the resulting benefits of the new application – is most important. If there is no way to defend gains in the marketplace, then all competitors will be able to duplicate the innovative system. The cost structure of the industry as a whole will change but no firm will gain competitive advantage and the innovation cannot provide advantage. Most external or customer focused systems have relied on customers' switching costs to defend initial gains in the marketplace. *Switching costs* are costs incurred by the customer when changing vendors or suppliers. These generally include the time and expense to investigate the new supplier, gain assurances of quality and timeliness of delivery, and then negotiate a contract [13]. Externally focused systems have the ability to add electronic handcuffs; the customers may be happy captives, but they are captives none-the-less. Examples include necessary software interfaces that customers develop to communicate with electronic order entry and distribution systems; investments in proprietary hardware, in training, and in the entry of necessary databases; and the loss of valuable transaction histories that the vendor's system captures and provides automatically. A pharmacy changing distributors needs to learn to use their new system; retraining and new hardware may be required. It will be necessary to re-enter databases. And valuable and irreplaceable transaction histories will probably no longer be available. A travel agency changing computerized reservation systems is likely to face many of the same switching costs. Moreover, the initial developers of travel agent reservation systems now enjoy very substantial advantages in the domestic market, advantages that can be used to augment switching costs for agencies; for example, the user of an airline's own reservation system is given higher priority in booking flights that are in great demand; this is a strong disadvantage to smaller airlines or airlines less concentrated domestically, when they attempt to offer systems competing with the established agency systems.

Other defenses are available. However, when an externally focused innovation results in substantial customer switching costs, its benefits are likely to be sustainable, *regardless* of competitors' actions. When customers' adoption is rapid, and their switching costs are significant, the initial developer may enjoy real first mover effects. Such innovations can be considered *strategic preemptive strikes*.

4.2. Internally Focused Applications

By definition, internally focused systems do not offer the possibility of customer switching costs. Again, the system must provide benefits to the firm; this once more will require that the system be consistent with the firm's strategy. And again, there must be time to harvest these benefits. Time will be provided entirely by barriers that prevent competitors from duplicating the application. These barriers are less easily quantified than switching costs. They are apparently less satisfying than barriers that succeed regardless of competitors' efforts.

Factory automation, and manufacturing systems in general, provide examples where applications are potentially universally available, but where benefits have not been realized by all firms. Some developments are prohibitively expensive: Ford Motor's Taurus and Sable cost billions to

develop, and although this effort was feasible for Ford, at some risk, it probably could not have been attempted by a smaller manufacturer. This is an example of a *scale advantage*, made possible by superior size. Some factory automation systems are difficult to justify in terms of traditional cost accounting. Although the benefits are quite real, they have proved very difficult to quantify. Full benefit often requires radical redesign of the entire organization, including: integration of design, manufacturing engineering, and manufacturing; changing incentive structures; changing relationships with suppliers; and changing the relationship between management and organized labor [10]. A firm must therefore be willing to innovate, and to accept uncertainty in its planning. Ford's Taurus and Sable are examples of success; GM's Buick operations have initially had less success. Some organizations that can not or will not undergo such radical reorganization can not obtain full benefits of new technology. Another source of advantage, or another barrier to competitors, is differing levels of skill in finding strategic opportunities to use information technology and in successfully and effectively completing information system applications. No doubt augmenting their information systems skill base was a major factor in GM's acquisition of EDS. Other advantages come from managerial experience and expertise: contrast GM's slow automation benefits with the immediate and striking success of their Fremont, California joint venture with Toyota [7]. Patents and other forms of protection for proprietary developments can also provide significant barriers to competitors.

Airlines with travel agent reservation systems already enjoy extensive telecommunications expertise. Real time control of internal operations, in particular coordination of connecting flights when schedules have slipped slightly, can be managed effectively exploiting this expertise; competitors lacking massive real time communications capabilities have difficulty providing equivalent computer assisted coordination.

Barriers other than switching costs are also effective in externally focused systems. For example, early developers of reservation systems, frequent flyer bonus programs, and retail customer order entry systems continue to innovate and improve their programs, and thus stay ahead of their competition.

The following short list summarizes sources of defensive barriers other than those based on switching costs:

- scale on scope advantages
- superior managerial adaptability or willingness to redesign the organization
- superior managerial vision or willingness to accept risk
- superior skill base or experience in information technology
- superior managerial experience in exploiting innovation
- continuing innovation to maintain competitive position
- existing infrastructure that can be exploited
- patents or other forms of statutory protection

This characterization has proved useful in assessing potential information systems applications. Applications that do not satisfy at least one of these conditions may still be interesting, but they are unlikely to be strategic. The fact that a system cannot be protected from copying by competitors, and that it will become a commodity service, may argue strongly against absorbing the extra cost of early introduction. However, IBM, Diebold, and other manufacturers of ATMs surely earned considerable amount of money from their widespread adoption. This leads to another use of the characterization: if an IS innovation is likely to develop into a commodity, and if this development is recognized sufficiently early, there may still be considerable value in being the the provider of that commodity. An example is a bank that seeks competitive advantage not through using its ATMs to reach retail customers but by serving as a service bureau for banks too small to process their own ATM transactions. Of course, if one's position as a provider of an information commodity provider is to be truly valuable, this position also must be defended in some way.

5. Relationship Between IS and Strategic Planning

The importance of selecting strategic opportunities, applications that not only can be defended but that are consistent with and support the firm's strategic objectives, requires real links between MIS and strategic planning. It also requires the ability to seek out, to find, and to recognize these strategic opportunities.

Finding strategic opportunities, even more than selecting promising ventures, requires strong links among information systems, line management, and senior management. MIS understands technology – it provides an understanding of the rapidly changing art of the possible. Line management understands customer needs and company opportunities, all along the firm's value chain. And senior management provides an understanding of the firm's strategic goals and strengths and weaknesses. Additionally, systems effects or synergies can be essential; MIS understands the infrastructure and capabilities already in place, and senior management understands the portfolio effects of complementary applications.

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