

A Framework for the Quantitative Assessment of Sustained Competitive Advantage in Strategic Information Systems

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ABSTRACT

An analytical framework is proposed to quantitatively assess the sustainability of competitive advantages derived from strategic information systems. The framework is based on an evaluation of a firm's relative strength using basic input factors considered necessary for development of strategic information systems as well as unique organizational characteristics that may be exploited for strategic advantage. The usefulness of the framework is illustrated by applying it to three well-known strategic information systems developed by companies in three different industries.

INTRODUCTION

The strategic significance of information technology (IT) in today's business environment is without question. An increasing number of organizations are looking to IT to help support, and even formulate, their corporate strategies. This has led to the development of strategic information systems (SIS) in large organizations. Rackoff, Wiseman, and Ullrich [38] broadly define SISs as information systems used to support or shape a firm's competitive strategy and its plan for gaining and/or maintaining a competitive advantage. This is to be distinguished from information systems that are developed primarily as a means for survival rather than for creating a competitive advantage. Many strategic IT investments today are for the development of systems that are more strategic necessities than strategic weapons [17, 31]. These systems are developed to avoid competitive disadvantage. This is primarily because opportunities to apply technology are usually open to all competitors, and failure to adopt a technology application leaves a firm vulnerable to other players.

Sustaining the competitive advantage brought about by

IT is a primary objective of many firms [19]. However, many argue that it is very difficult for the original developer of an SIS to sustain the competitive advantage resulting from implementation of the system [9, 11, 12, 19, 28, 29, 42]. Often, other companies imitate the SIS, thereby eroding the competitive advantage initially enjoyed by the original developer. Two well-known examples of this situation are Citibank's automated teller machines (ATMs) and American Airline's automated reservation system, SABRE. Thus, the issue of sustaining competitive advantage is of critical importance to practitioners as well as researchers.

Considering the fact that most initial SISs require development efforts that tend to be large, complex, and costly, it would be beneficial for firms to have access to an analytical framework that helps evaluate whether or not a particular SIS application can create a competitive advantage that is sustainable. Existing frameworks, such as the one developed by Feeny & Ives in 1990 [22], do not allow a firm to evaluate sustainability in a measurable way.

In this paper, a comprehensive, analytical framework designed to assess the potential for an SIS to create a sus-

tainable competitive advantage is presented. The framework permits a quantitative estimation of the sustainability of the expected competitive advantage through the computation of a sustainability index.

The next section of the paper reviews the literature pertaining to the competitive advantage of IT as well as its sustainability. This is followed by a description of the proposed analytical framework. Next, use of the framework is illustrated by applying it to three well-known examples of strategic information systems. Conclusions are then offered along with some implications of the model. Finally, some directions for further research are given.

SUSTAINING COMPETITIVE ADVANTAGE

Many studies have been conducted on how IT is used to create competitive advantage [1, 5, 11, 13, 24, 27, 30, 33, 35, 36, 38]. Collectively, these studies indicate that IT creates competitive advantage for an organization by enabling it to do the following:

- a) Become a more efficient and effective producer.
- b) Differentiate its products and/or services from its competitors'.
- c) Change supplier relations by increasing its bargaining power with suppliers.
- d) Reduce customer power by increasing switching costs for customers.
- e) Create new products and/or services.
- f) Change the rules of competition by shattering traditional boundaries of geography and industry.

While the above strategies show how firms can use IT for competitive advantage, doubts have been raised in the research community about the sustainability of this advantage [4, 7, 8, 13]. In the present context, sustained competitive advantage is defined as the benefits that are created and maintained for a period of time long enough to recover initial development costs of an SIS and to compensate the initiating firm for risks taken as first developer of the SIS. Additionally, the SIS should produce profits for the firm even after competitors are technically able to develop and implement the same or similar system [4].

Clemons [7, 8] states that true opportunities for achieving sustainable competitive advantage are relatively rare. Competitors often benefit from the original developer's experience and duplicate the system—sometimes with newer technology—allowing comparable services to be delivered at lower costs [13]. For example, ATMs provided Citibank with a competitive advantage but only for a relatively short period of time since, by 1986, ATMs were being offered by almost all banks [9, 28, 29]. Today, ATMs provide neither margin nor market share advantage but are largely a strategic

necessity.

Kemerer and Sosa [28] also note that American Airlines' SABRE system's profit margin had dropped 50 percent in only two years, from 1985 to 1987, due to other airlines' implementation of similar systems. Similar observations have been made about other well-known SISs such as Mckesson Drug Company's electronic order entry system, Economost [11].

Therefore, the desired objective in implementing an SIS is not only to create competitive advantage but, also, to sustain the advantage created. This is the challenge facing a firm that is considering a new investment in an SIS. Some research has been done to understand how IT can be a source of sustained competitive advantage [7, 9, 10, 13, 22]. From these studies came a conceptual framework for evaluating the sustainability of IT applications [22]. While useful, this framework does not allow a firm to evaluate sustainability in a measurable way.

A new framework is proposed. This framework incorporates ideas and findings from prior research into the development of a quantitative measure of sustainability of competitive advantage.

A FRAMEWORK FOR MEASURING SUSTAINABILITY

It is clear from the discussion in the preceding sections that when a sufficient number of competitors quickly duplicate an SIS, they can gain similar benefits as the original developer, thereby eroding the initial competitive advantages enjoyed by the latter. Therefore, in order for the competitive advantages created from an SIS to be sustained, one or more of the following conditions must prevail:

1. Only a relatively small number of firms have the capability to duplicate the applications of the SIS.
2. A significant period of time passes before competitors are able to duplicate the applications and/or benefits of the SIS.
3. Even when competitors are technically able to duplicate the SIS, other factors (e.g., unique organizational strengths of the original developer) prevent them from gaining significant benefits from it.
4. The original developer is able to maintain a lead through constant innovation.

This section describes an analytical framework designed to help a firm evaluate the sustainability of the competitive advantages expected from an SIS. The end result of the analysis is the computation of a sustainability index, which indicates the degree to which the expected advantages are sustainable. In essence, the framework helps a firm to quantitatively evaluate its ability to positively influence the conditions listed above.

FIGURE 1

Overview of Framework for Measuring Sustainability of Competitive Advantage

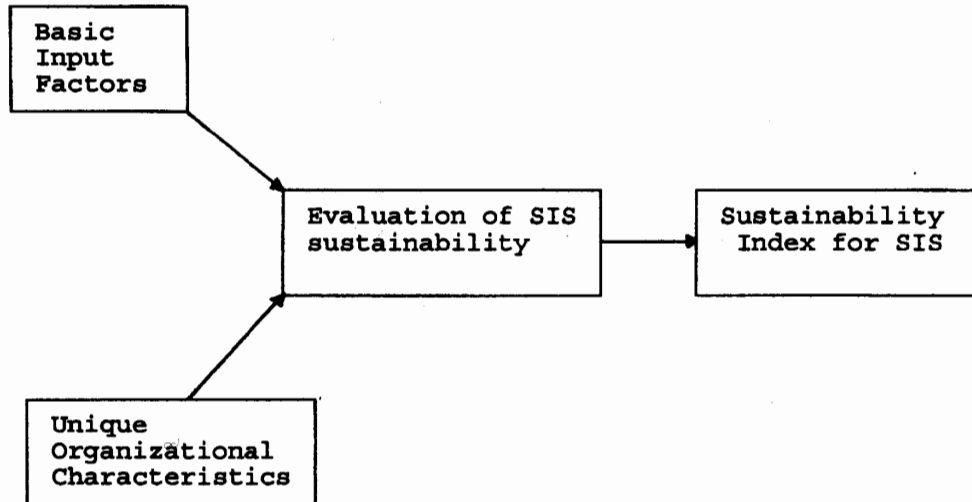


FIGURE 2

Basic Input Factors

1. IT Infrastructure:

- computing platform(s): hardware and software
- flexibility / adaptability of information architecture
- dispersion of IT in business / functional units
- integration of IT in business processes
- use of IT by management

2. IT Expertise / Know-how:

- IT staff competence
- understanding of how IT can support business goals and objectives
- commitment to ongoing IT education / training throughout organization
- commitment to ongoing research and development in IT

3. Financial Resources:

- availability of financial resources for IT projects
- availability of financial resources for IT research and development
- availability of financial resources for IT education and training

Figure 1 shows a schematic overview of the framework. The factors that go into the evaluation of sustainability and, ultimately, into the computation of a sustainability index are basic input factors and unique organizational characteristics.

Basic Input Factors

Basic input factors are primarily the technical and financial resources that are necessary for the development of an SIS. Three basic input factors are identified in this study: (a) IT infrastructure (b) IT expertise or know-how and (c) financial resources. These factors play a critical role in determining an organization's ability to utilize technology effectively and advantageously, including the ability to exploit new technology as well as the experience and capability to manage large and technically complex information systems projects. Coupled to these, of course is the availability and commitment of financial resources to support such projects. Figure 2 shows the three basic input factors, including elements comprising each factor.

UNIQUE ORGANIZATIONAL CHARACTERISTICS

While possession of the basic input factors may give an organization the ability to develop an SIS, experience has shown that unless the SIS is designed to exploit or enhance those special characteristics or strengths that the organization possesses, the expected competitive advantages are usually not sustainable in the long run. This is primarily because competitors usually possess (or can obtain) the basic input factors with which to duplicate the SIS. However, they cannot as easily duplicate the originator's unique organizational characteristics. The present study identifies five unique organizational characteristics that can be exploited to produce benefits. They are: (a) structural characteristics (b) management/process characteristics (c) market-related characteristics (d) product/service characteristics and (e) human resources. These organizational characteristics are shown in Figure 3, together with some factors that contribute to each characteristic.

Imitability of Input Factors and Organizational Characteristics

Sustaining the competitive advantage obtained from an SIS depends largely on the degree to which the basic input factors and organizational characteristics are inimitable. If these factors and characteristics are not easily imitated by competitors, then there is a strong likelihood that the competitive advantage can be sustained. Otherwise, it would be relatively easy for competitors to duplicate the SIS and erode the advantage. Therefore, a firm would need to assess the degree to which each input factor and organizational charac-

FIGURE 3

Unique Organizational Characteristics

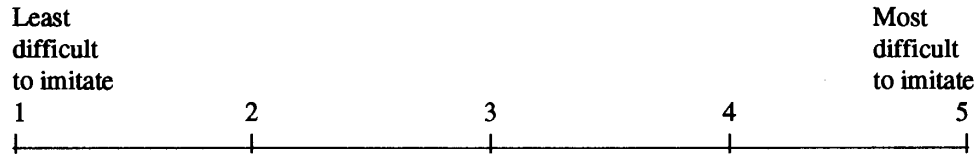
1. **Structural Characteristics:**
 - size of organization
 - vertical integration
 - centralization/decentralization
2. **Management / Process Characteristics:**
 - management skill and vision
 - management/organizational process
 - organizational culture
 - business/IT strategy
 - IT leadership
3. **Market-related Characteristics:**
 - market share
 - geographical location
 - organizational reputation
 - relationship with suppliers
 - relationship with rivals
 - relationship with customers
 - customer type
 - customer loyalty
 - special alliances
4. **Product / Service Characteristics:**
 - type of product/service
 - product breadth
 - distribution line
 - diversification
 - legal protection or patent ownership
5. **Human Resources:**
 - sales personnel
 - negotiation power/expertise

teristic is inimitable. This can be done by means of an internal firm analysis, a competitor (and potential competitor) analysis, and a market analysis. The result of these analyses is an inimitability score for each input factor and organizational characteristic, derived from the five-point scale shown in Figure 4.

To help in obtaining the inimitability score for a particular input factor, a firm should evaluate its overall strength (relative to its competitors') in all of the subordinate items listed under that factor in Figure 2. For example, to obtain an inimitability score for IT infrastructure, the firm would need to evaluate the reliability, flexibility, and adaptability of its information architecture and computing platforms, the extent to which IT is utilized by management and functional units,

FIGURE 4

Five-point Scale for Evaluating Inimitability

**Scale values:**

- 1 = Readily available in the open market and to the competition.
 2 = Not available in the open market but easy to create internally.
 3 = Not available in the open market and needs time to be created internally since some internal adjustment is needed to start the process.
 4 = Gained only through internally accumulated efforts over a long period of time.
 5 = Nearly impossible to possess.

the degree to which IT is integrated in business decision processes, etc. Similarly, Figure 3 is used to obtain inimitability scores for each of the unique organizational characteristics. If an input factor or organizational characteristic can be easily duplicated or is readily obtainable in the open market, then it does not contribute significantly to the sustainability of competitive advantage; a low inimitability score must be awarded to that factor or characteristic. By

contrast, a high inimitability score is awarded to an input factor or organizational characteristic whose benefits are difficult to obtain or duplicate and which can, therefore, be exploited for competitive advantage. An example of this might be a unique and highly specialized technical know-how that has been accumulated over a long period of time or an already present dominance in market share, with very strong customer loyalty.

TABLE 1

Relative Importance of Basic Input Factors and Unique Organizational Characteristics

Factor	Factor Weight
Basic Input Factors:	
IT infrastructure	.11
IT expertise/know-how	.11
Financial resources	.13
<hr style="border-top: 1px dashed black;"/>	
<i>Total composite weight (input factors):</i>	.35
Unique Organization Characteristics:	
Structural characteristics	.10
Management/Process characteristics	.15
Market-related characteristics	.15
Product/service characteristics	.15
Human resource	.10
<hr style="border-top: 1px dashed black;"/>	
<i>Total composite weight (unique organization characteristics):</i>	.65

The relative importance of the basic input factors and unique organizational characteristics is reflected in the weights assigned to each of them, as shown in Table 1. Research and market experience have shown that unique organizational characteristics are more likely to constitute a source of sustained competitive advantage than basic input factors [2, 3, 4, 13, 20, 29]. Therefore, composite weights of .35 and .65 have been assigned to the basic input factors and unique organizational characteristics, respectively. While these weights were not determined from rigorous research designed specifically for this purpose, they are reasonably consistent with suggestions from the literature.

The composite weight of .35 for the basic input factors comprises individual weights of .11 for IT infrastructure, .11 for IT expertise/know-how, and .13 for financial resources. These three factors are considered to be approximately equal in importance, with respect to developing an SIS. The slightly higher weight assigned to financial resources is based on the fact that, with adequate financial resources, an organization could acquire needed IT expertise and/or infrastructure through direct hiring of people with the requisite skills and/or through acquisition of a firm with those skills and resources. The composite weight of .65 for the unique organizational characteristics comprises a weight of .15 for each of the following: management/process characteristics, market-related characteristics, and product or service characteristics, and a weight of .10 for each of the following: structural characteristics and human resources. This weight distribution reflects the preeminence of management vision and leadership in exploiting product/service characteristics and market conditions for competitive advantage.

Sustainability Index for SIS

Computation of a sustainability index for an SIS involves a mathematical combination of the weighted inimitability scores for the basic input factors and the unique organizational characteristics. Specifically, the inimitability score previously obtained for each factor and characteristic is multiplied by the corresponding factor weight to give the weighted score. These weighted scores are then summed to give the sustainability index for the SIS. The maximum possible value for the sustainability index in this scheme is 5.0. Computation of the sustainability index may be stated formally as follows:

$$\begin{aligned}
 S.I._{SIS} &= \text{weighted inimitability score for basic input factors} + \text{weighted inimitability score for unique org. characteristics} \quad (1) \\
 &= \sum_{i=1}^p w_i (I_{BIP})_i + \sum_{j=1}^q w_j (I_{UOC})_j
 \end{aligned}$$

where:

- S.I._{SIS} = sustainability index for SIS
- (I_{BIP})_i = inimitability score for basic input factor i
- (I_{UOC})_j = inimitability score for unique organization characteristic j
- w_i = weight of basic input factor i
- w_j = weight of unique organizational characteristic j
- p = number of basic input factors = 3
- q = number of unique organizational characteristics = 5

The sustainability index, S.I._{SIS}, indicates the degree to which competitive advantages from an SIS are sustainable. The higher the index, the greater the likelihood of sustainability. Constructing a sustainability index for an SIS should help a firm evaluate the system's potential benefits.

We would like to reiterate the relative importance of the unique organizational characteristics in determining sustainability. It is for this reason that the basic input factors and unique organizational characteristics are deliberately stated separately in the formulas above, instead of collapsing the formulas into a single weighted sum of eight factors. Organizational characteristics have traditionally not received the emphasis that they deserve, within the context of SIS development, and our intention is to help counter that tendency. Also, separation of these items facilitates further discussion later on in the paper.

APPLICATION OF THE FRAMEWORK

In this section, the framework is applied *ex post facto* to assess the sustainability of the competitive advantages from SISs developed by three companies. These are: (a) McKesson Drug Company's electronic order entry system, Economost (b) Merrill Lynch's Cash Management Account (CMA) and (c) Rosenbluth Travel's READOUT/VISION/PRECISION travel information systems. These systems were selected for a number of reasons. First, the companies were all first movers in their respective industries. This is important because the proposed framework is designed primarily to help firms evaluate the sustainability of competitive advantages from original systems rather than as a reactive mechanism to competitors' systems. Second, the strategic purpose of each system had been intentionally formulated by the time of development. Cases that represent intentional strategic use of IT are more appropriate for this framework than those that represent incidental use of IT. Finally, the impact of these strategic systems on their respective markets is already stable. Therefore, the *ex post facto* nature of the analysis provides a useful insight into true sustainability and serves as a validating mechanism for the framework. Evaluation of the SISs is based on a content analysis of each system. Relevant data were collected from a number of sources [6,11,12,14,15,16,18,21,23,25,26,32,34,39,40] and analyzed using the framework.

McKesson Drug Company: Economost

McKesson Drug Company is a wholesale drug distributor. In 1975, it developed Economost, an electronic order entry system, as an SIS. The primary objective for Economost was to halt the erosion of McKesson's market share to drug manufacturers who, from around the mid-1960s through the mid-1970s, had begun to rely more on direct distribution of their drugs and less on wholesale distributors such as McKesson [11]. Through Economost, McKesson intended to add value to its distribution process by applying sophisticated IT to its operations in order to make the company so efficient at distribution that manufacturers could not possibly do as well on their own [25]. This would also differentiate McKesson from other drug distributors.

At the heart of the Economost system is a hand-held order entry device which makes it possible for a retailer to place orders with a single pass through the store. McKesson is able to fill most orders on the same day they are placed or the following day, at the latest. The company also provides retail pharmacists (its major customers) with valuable management control information, much of which would be too expensive for them to provide for themselves. Price stickers and replacement stickers for repricing items are also provided through the system. Additionally, McKesson encourages its customers to place one or two orders each week by offering discounts based on volume and delivery frequency through Economost.

Sustainability indices were computed for Economost under three different competitive conditions: first, against drug manufacturers, who were the main target competitors; next, against other major wholesale distributors; and, finally, against smaller distributors. Table 2 shows the computation of the sustainability index for Economost versus the drug manufacturers. With respect to the input factors, McKesson holds significant advantages which would be difficult for the manufacturers to duplicate. Prior to the development of Economost, McKesson had implemented a short-line electronic order entry system called Econotone, which served customers in northern California. The company also utilized a sophisticated inventory management system capable of handling its large stock of diverse products from many different manufacturers. This system was run through fully automated warehouses. Therefore, McKesson had a relatively advanced IT infrastructure as well as the requisite experience and expertise for developing a nation-wide order entry system such as Economost. Additionally, McKesson, being a distributor, could more easily afford to concentrate its financial resources on the development of a highly sophisticated distribution system than could drug manufacturers, who need to focus significant financial resources on research and development. On these bases, Economost receives a high sustainability score for the basic input factors.

McKesson was also able to exploit some of its organiza-

TABLE 2
Sustainability Index of Economost vs. Drug Manufacturers

Factor	Factor Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	4	.44
IT expertise/know-how	.11	4	.44
Financial resources	.13	3	.39
Unique Organizational Characteristics:			
Structural characteristics	.10	4	.40
Management/Process characteristics	.15	3	.45
Market-related characteristics	.15	5	.75
Product/service characteristics	.15	5	.75
Human resource	.10	4	.40
Sustainability Index = 4.02			

tional characteristics that were unique, relative to manufacturers, for the purpose of obtaining and sustaining competitive advantage from its Economost system. As a value-adding distributor of pharmaceuticals, McKesson is not completely vertically integrated. This characteristic enabled the company to cost-effectively utilize IT to handle purchasing from many manufacturers and distribute virtually all of the products to a retailer. It is very difficult for a single manufacturer to meet the bulk of a retailer's demand by producing most of the products requested by the retailer, especially since these retailers typically need only small amounts of various products with any one order.

McKesson also used Economost to diversify its operations to include the distribution of foods, chemicals, and automotive-related products. The company was thus able to enjoy economies of scope as well as increase its bargaining power relative to its suppliers.

By computerizing order-entry operations, it became possible for McKesson to better utilize its sales force. Sales personnel became consultants to McKesson's customers, developing better relationships with these customers. It was difficult for manufacturers to constantly maintain such sales personnel.

A sustainability index of 4.02 (out of a maximum possible 5.0) is computed for Economost. This is a strong indication that Economost would provide a sustained competitive advantage over the manufacturers. This has been borne out

in practice. Direct sales by manufacturers to pharmacies and chain stores have continued to drop since Economost went on-line [8, 34]. By contrast, utilization of Economost (or similar systems) for the distribution of drugs is on the increase [8].

When the framework is used to evaluate Economost vis-a-vis other major wholesale drug distributors, however, an entirely different result emerges (see Table 3). Against these competitors, McKesson holds very few advantages with respect to the basic input factors. Companies like Bergen-Brunswig, McKesson's largest national-level competitor, already had the IT infrastructure and basic IT expertise in place, in addition to having similar financial resources. However, McKesson was the largest drug distributor and could therefore enjoy bigger economies of scale than these players. It was thus virtually impossible for these competitors to increase their market shares quickly. They were forced into a reactive mode and needed some adjustment in management focus and human resource training in order to meet the challenge posed by Economost. The sustainability index computed for Economost vis-a-vis the major distributors is 2.21 — a significantly lower figure than that computed earlier when the target competitors were the drug manufacturers. This index is indicative of a small likelihood of sustaining any competitive advantage from Economost with respect to other major distributors.

Indeed, Bergen-Brunswig and several other major na-

TABLE 3
Sustainability Index of Economost vs. Major Distributors

Factor	Factor Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	1	.11
IT expertise/know-how	.11	2	.22
Financial resources	.13	1	.13
Unique Organizational Characteristics:			
Structural characteristics	.10	1	.10
Management/Process characteristics	.15	3	.45
Market-related characteristics	.15	4	.60
Product/service characteristics	.15	2	.30
Human resource	.10	3	.30
Sustainability Index = 2.21			

tional and regional competitors responded to Economost by developing compatible systems [8, 41]. This quickly reduced the monopolistic advantage enjoyed by McKesson as a result of the Economost system.

Against small distributors, Economost accords McKesson a big competitive advantage that promises to be highly sustainable. Table 4 shows a sustainability index of 4.28 for Economost when it is evaluated against the smaller distributors. The massive investments of financial, technical, and human resources required to implement an SIS like Economost put these small distributors at a significant disadvantage. Additionally, these companies can only compete in small markets and with narrow product lines. Their response to Economost and other similar systems was to leave the business, find a smaller niche, get acquired, or grow through merger. In the early 1970s, there were 180 wholesale drug distributors but by 1986, this number had been reduced to 90 [11]. Much of this concentration was the result of smaller companies being forced out of the business or being compelled into merger and consolidation.

The sustainability indices computed for Economost show that the system has the potential to give McKesson a sustained competitive advantage over manufacturers and small distributors but little potential for sustaining a long-term competitive advantage over large distributors. Overall, the total impact of Economost was considerable: McKesson's sales increased 424 percent from 1975 to 1987, while its operating

expenses increased only 86 percent [11].

Merrill Lynch & Company, Inc: CMA.

Merrill Lynch & Company Inc. is a securities firm. In 1977, it introduced a new IT-based financial service called the Cash Management Account (CMA). The goal in implementing this system was to help Merrill Lynch capture new individual investors. This was necessitated by the fact that deregulation in 1975 had dramatically decreased revenues that securities firms obtained from institutional investors, their other major client group.

CMA is a central asset account service which combines a checking account, a debit card, and money market funds (MMFs). The CMA checking account balance is invested in MMFs, whose returns are money market rates. At the time that CMA was introduced, the returns on MMFs were significantly higher than banks' interest rates. Furthermore, it was illegal for banks to offer MMFs. CMA, therefore, offered individual investors access to MMFs, together with services similar to those offered by banks. In other words, Merrill Lynch attempted to increase its customer base—and the associated revenues—at the expense of the banking industry through CMA.

Computation of a sustainability index for CMA, relative to the banking industry, is shown in Table 5. Since banks were prohibited legally from offering products similar to

TABLE 4
Sustainability Index of Economost vs. Small Distributors

Factor	Factor • Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	4	.44
IT expertise/know-how	.11	4	.44
Financial resources	.13	5	.65
Unique Organizational Characteristics:			
Structural characteristics	.10	4	.40
Management/Process characteristics	.15	3	.45
Market-related characteristics	.15	5	.75
Product/service characteristics	.15	5	.75
Human resource	.10	4	.40
Sustainability Index = 4.28			

TABLE 5
Sustainability Index of CMA vs. Banks

Factor	Factor Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	4	.44
IT expertise/know-how	.11	3	.33
Financial resources	.13	1	.13
Unique Organizational Characteristics:			
Structural characteristics	.10	3	.30
Management/Process characteristics	.15	4	.60
Market-related characteristics	.15	4	.60
Product/service characteristics	.15	5	.75
Human resource	.10	4	.40
Sustainability Index = 3.55			

MMFs, no bank had an IT infrastructure or expertise comparable to Merrill Lynch's for processing MMF operations. Even though outsourcing was available to banks, Merrill Lynch still had the advantage. The company estimates that by the fall of 1976, it had invested about 100 person-years of computer programmer time in developing the information systems to ensure the feasibility and legality of CMA [12]. On the other hand, Merrill Lynch had no advantage as far as financial resources were concerned.

In addition to the above input factors, there were several unique organizational characteristics that were exploitable by Merrill Lynch. First, Merrill Lynch had a senior management team with a vision about IT possibilities. They devised a diversification strategy that relied heavily on IT capabilities. Merrill Lynch was barred by law from issuing checks and debit cards. However, the company's senior management overcame this obstacle by contracting with Bank One of Columbus to provide these banking services. Through daily, sophisticated electronic banking and accounting, Merrill Lynch was able to make CMA feasible as well as legal.

Second, Merrill Lynch was able to take advantage of the fact that banks were legally barred from offering MMFs and could, therefore, not duplicate the success of CMA even if they wanted to. Additionally, Merrill Lynch could offer a unique product—securities instruments—which banks could not directly offer to their customers. The company also provided its customers with financial counseling services

along with the financial instruments, further ensuring the customers' loyalty.

Based on these factors, a sustainability index of 3.55 is computed for Merrill Lynch's CMA, when evaluated against banks. This value indicates that the competitive advantage that Merrill Lynch expected from its CMA had a strong chance of being sustainable. This turned out to be the case. CMA was very successful in luring individual customers away from banks to Merrill Lynch. This success forced banks to resort to legal action in 22 states. In December of 1982, banks were finally given the legal authority to offer competitive interest rates through money market deposit accounts (MMDA). By then, Merrill Lynch's advantage was already substantial.

The sustainability of the expected competitive advantage from CMA is next evaluated against other major securities firms. Computation of the sustainability index from this evaluation is shown in Table 6. With respect to the input factors, these major competitors have a basic IT infrastructure in place. However, Merrill Lynch's vision of the major role that IT could play in the merging of diverse financial services gave them an advantage. From the early to mid-1970s, Merrill Lynch enhanced its IT infrastructure and expertise by increasing its information systems capacity and by secretly developing the necessary software for effective and legal implementation of CMA.

Over the years, Merrill Lynch's aggressive senior man-

TABLE 6
Sustainability Index of CMA vs Major Securities Firms

Factor	Factor Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	3	.33
IT expertise/know-how	.11	2	.22
Financial resources	.13	1	.13
Unique Organizational Characteristics:			
Structural characteristics	.10	4	.40
Management/Process characteristics	.15	4	.60
Market-related characteristics	.15	4	.60
Product/service characteristics	.15	3	.45
Human resource	.10	2	.20
Sustainability Index = 2.93			

agement team had developed an organizational culture that was able to absorb any fears that may have accompanied the introduction of an uncertain and potentially problematic product—CMA—which was designed to compete directly with their primary institutional investors, namely banks. The same cannot be said for any of Merrill Lynch's competitors. Even when they finally became aware of the existence of CMA, these competitors still were unsure about its legality. They all thought that CMA would be deemed illegal due to the banking industry's opposition. Moreover, they were afraid that the existence of central asset accounts would damage their relationships with banks, which were important institutional clients. Central asset accounts would also reduce the free-credit balance in customer margin accounts, which were an important financial source for securities firms.

Therefore, while Merrill Lynch revamped its IT infrastructure and accrued benefits from CMA, its competitors waited. It was not until the end of 1981, when it became obvious that CMA was legal, that any of them offered a product with the full capability of a CMA. By that time, the number of Merrill Lynch's CMA accounts had grown to 580,000, representing \$33 billion in assets including over \$12 billion in the CMA Money Fund [12].

Additionally, Merrill Lynch's sheer size dominated the competition. It had the largest number of account executives and offices. Indeed, at the time, Merrill Lynch was more than double the size of its nearest competitor in terms of the

number of account executives and offices [12]. Since CMAs were sold through Merrill Lynch's offices by account executives, the company had advantages over its competitors in the distribution of the product.

Table 6 shows a sustainability index of 2.93 for CMA, relative to other major securities firms. This value indicates a moderate degree of sustainability. Market events since stabilization of the impact of CMAs have supported this assessment. Merrill Lynch's major competitors, such as Dean Witter, Paine Webber, Prudential-Bache, and Shearson American Express, have been able to duplicate the success of CMA by offering their own versions of a central asset account service, even if belatedly. Bank One and Provident National Bank of Philadelphia offered the necessary banking services to these competitors. However, duplication of CMA services by these companies did not completely erode Merrill Lynch's competitive advantage. This is because of the big head-start it had over its competitors. Today, Merrill Lynch continues to be the largest player in the money fund management business. At the end of 1990, it had a record \$356 billion in client assets, almost twice as much as its nearest competitor. Over \$229 billion of these assets came from 1,350,000 CMAs [32].

Rosenbluth Travel: READOUT/VISION/PRECISION

Rosenbluth Travel is a travel agency which developed a number of integrated information systems to help increase its

market share. In particular, it sought to capture new clients in the business travel market.

After deregulation in 1978, it became more cost-effective for airlines to rely on travel agencies to handle the increasingly complex environment of frequent fare and route changes [18]. To distinguish its services from those of other travel agencies, Rosenbluth Travel turned to IT. The company developed a number of information systems to facilitate business travel arrangements. (Prior to this, the bulk of their revenues—as well as those of other travel agencies— came from the leisure travel market.) While its competitors continued to use the airlines' computer reservation systems to do business, Rosenbluth Travel developed READOUT, VISION, USERVISION, PRECISION, and ULTRAVISION for added flexibility and value.

READOUT provided a more flexible and efficient method of listing flights. Unlike the airlines' systems which only listed flights by time of departure, requiring a change of screen to access fares, READOUT could display flights for a particular city pair in order of increasing fare. This capability enabled Rosenbluth Travel to recommend the best fares to corporate clients and help them reduce their travel expenses.

VISION is a database developed to collect business travel information at the time of transaction. Even though airline computer reservation systems were still used for booking reservations, the information of all transactions al-

ways went to VISION. This information enhanced Rosenbluth Travel's position in negotiating fares with airlines. Indeed, Rosenbluth Travel pioneered the route-by-route negotiated fare program with airlines by means of the VISION database. Rosenbluth Travel developed USERVISION, a flexible, PC-based query system via which clients could directly link their internal systems to the VISION system and gain access to the database.

In 1988, Rosenbluth Travel developed PRECISION. This system made available to the reservation clerk all relevant corporate and individual client profiles. It also provided information about fares, including Rosenbluth Travel's or company-specific negotiated fares from the READOUT database. This way, PRECISION was able to more precisely meet client travel requirements by making both special fares and client travel profiles available at the reservation point.

To fully integrate these systems and thus increase the total level of services, ULTRAVISION was developed. This system monitors transactions for completeness and accuracy by using criteria from the VISION database and integrating these with the normal reservation process.

These IT-based systems developed by Rosenbluth Travel gave the company a tremendous increase in sales and market share. The potential for sustaining this competitive advantage derives more from the impact of these systems on small travel agencies than on the larger ones, as Tables 7 and 8

TABLE 7
Sustainability Index of Rosenbluth Travel Systems vs. Small Agencies

Factor	Factor Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	4	.44
IT expertise/know-how	.11	4	.44
Financial resources	.13	5	.65
Unique Organizational Characteristics:			
Structural characteristics	.10	3	.30
Management/Process characteristics	.15	4	.60
Market-related characteristics	.15	4	.60
Product/service characteristics	.15	5	.75
Human resource	.10	5	.50
Sustainability Index = 4.28			

TABLE 8
Sustainability Index of Rosenbluth Travel Systems
vs. Large Agencies

Factor	Factor Weight (A)	Inimitability Score (B)	Weighted Inimitability Score (A x B)
Basic Input Factors:			
IT infrastructure	.11	2	.22
IT expertise/know-how	.11	1	.11
Financial resources	.13	1	.13
Unique Organizational Characteristics:			
Structural characteristics	.10	3	.30
Management/Process characteristics	.15	4	.60
Market-related characteristics	.15	3	.45
Product/service characteristics	.15	2	.30
Human resource	.10	3	.30
Sustainability Index = 2.41			

show. The calculated sustainability indices for these systems, when evaluated against small and large agencies, are 4.28 and 2.41, respectively.

The smaller agencies, most of which were of the “mom and pop” variety, had neither the IT infrastructure/know-how nor the financial resources to develop competitive systems. Those that were not driven out of business were forced into consolidation with other companies via consortia, affiliate networks, and franchises in order to be competitive. Examples are U.S. Travel Services, Woodside Travel Management, and Hickory Travel Systems. Through such collaboration, these companies are able to obtain negotiating services, usually for a membership fee.

Another advantage that Rosenbluth Travel’s information systems gave to the company relative to the competition is the opportunity to change its business strategy. With its IT-based systems, Rosenbluth Travel guarantees savings through lower fares. The competition, on the other hand, typically tries to preserve clients by “rebating” some percentage of agencies’ commissions to them.

It is more difficult for Rosenbluth Travel to sustain its competitive advantage over bigger competitors such as Lifeco and Thomas Cook/Heritage/Crimson, because these companies have considerable financial resources, IT expertise, and negotiating power. Even though they may not have shown the same management vision about IT as Rosenbluth Travel did, they have the resources and capability to replicate the

system and its benefits. However, as a pioneer, Rosenbluth Travel is still expected to maintain some advantage in negotiating power and business strategy.

Overall, Rosenbluth Travel obtained significant benefits from its travel information systems. Most of these benefits did come at the expense of “mom and pop” agencies [15]. Ten years ago, Rosenbluth Travel was a regional travel agency with \$40 million in annual sales. In 1990, it became one of the five largest agencies in the United States with sales of over \$1.3 billion and over 400 offices nationwide.

With its sound IT infrastructure, Rosenbluth Travel is now in a position to offer global services. In 1988 it organized the Rosenbluth International Alliance (RIA). This alliance consists of 34 partners operating over 1,100 offices in 37 countries [16]. To successfully work with foreign members of this alliance, Rosenbluth Travel used its IT platform and United Airlines’ computer reservation system, APOLLO. In this arrangement, reservation information is automatically routed to the VISION database through APOLLO, and RIA members can access a client’s profile and travel plans. This system provides Rosenbluth Travel with the advantage of global purchasing power in dealing with airlines.

CONCLUSIONS AND IMPLICATIONS

The framework presented in this paper provides a means for quantitatively determining the sustainability of competi-

tive advantages from SISs. It is the first framework of its kind that provides this quantitative capability. The three cases described in the preceding section lend general support to the validity of the framework, based on the industry experiences of the respective SISs. In general, the framework computes a high sustainability index value for an SIS with a high potential for providing sustainable competitive advantages. For a particular SIS, the computed sustainability index value depends on the type of competitor against which the SIS is evaluated. A high sustainability index value is obtained when the competitors are small, and a low value is obtained when the target competitors are large and technologically sophisticated. This suggests that the competitive advantages from an SIS are more likely to be sustained at the expense of smaller competitors than larger ones. Therefore, identifying target competitors for an SIS project is very important. This is usually facilitated by an explicit statement of the objectives of the SIS project.

A summary of the results of the analysis of the three cases is shown in Table 9. The results can also be rank ordered based on sustainability index value, as shown in Table 10, to show the positive correlation between the index and the sustainability of competitive advantage. From this

table, it appears that a sustainability index value of 3.5 or greater is indicative of a strong potential for sustainable competitive advantage, while an index value less than 2.3 indicates poor potential for same. The evidence for sustainability is equivocal for values between these two points.

Table 10 also highlights the importance of the unique organizational characteristics relative to the basic input factors. In particular, the case of Merrill Lynch versus the banks (middle of the table) reveals that, despite a relatively low inimitability score on the basic input factors (0.90), Merrill Lynch still obtained a sustainable competitive advantage over the banks. This is clearly due to the relatively high inimitability score on the unique organizational characteristics. Indeed, this score (2.65) is almost identical to that obtained for the three highest ranked cases (2.75). By contrast, the difference between the inimitability score on the basic input factors for this case (Merrill Lynch v. banks) and that for each of the three highest ranked cases is much more significant. This supports the notion that unique organizational characteristics are more important in determining the sustainability of competitive advantage than the basic input factors.

The framework could also be used to assess the potential

TABLE 9
Summary of Case Analyses

Initiating Firm	Type of Competitor	Target Competitor	Competitor Response	Sustainability Index	Sustained Competitive Advantage
McKesson	Drug Manufacturers	Yes	No duplication	4.02	Yes
	Major Distributors	No	Immediate duplication	2.21	No
	Small Distributors	No	No duplication	4.28	Yes
Merrill Lynch	Banks	Yes	Very slow duplication	3.55	Yes
	Major Securities Firms	No	Very slow duplication	2.93	Not clear
Rosenbluth Travel	Small Travel Agencies	Yes	Very slow duplication	4.28	Yes
	Large Travel Agencies	Yes	Slow duplication	2.41	Not clear

TABLE 10
Case Studies Ranked by Sustainability Index Values

	Weighted Inimitability score for basic input factors	Weighted Inimitability score for unique organizational characters	Sustainability index (maximum = 5.0)	Sustained competitive advantage
McKesson vs. small distributors	1.53	2.75	4.28	Yes
Rosenbluth vs. small travel agencies	1.53	2.75	4.28	Yes
McKesson vs. drug manufacturers	1.27	2.75	4.02	Yes
Merrill Lynch vs. banks	0.90	2.65	3.55	Yes
Merrill Lynch vs. major securities firms	0.68	2.25	2.93	Not clear
Rosenbluth vs. large travel agencies	0.46	1.95	2.41	Not clear
McKesson vs. major distributors	0.46	1.75	2.21	No

of several proposed SISs to provide sustained competitive advantage. Each SIS would be evaluated using the framework. The one with the highest sustainability index value—indicating the strongest overall potential for sustained competitive advantage—is then selected as the best candidate. The quantitative data makes the comparison easier. Overall, the framework helps firms to design more effective strategic information systems.

LIMITATIONS AND DIRECTIONS FOR FURTHER RESEARCH

This paper has proposed a useful framework for measuring sustained competitive advantage from SISs. However, there are some inherent limitations in the study. First, the use of three case studies may not be sufficient as a basis for validating the framework. While these cases lend general support for the framework, a larger number of case studies should provide more comprehensive results that may improve the reliability of the framework.

Second, the weights assigned to the basic input factors and unique organizational characteristics, while reasonable and generally consistent with the literature, were not derived from a formal study designed specifically to determine the

relative importance of these factors. A more formal study might produce a slightly different weighting scheme.

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