Forging the Link: Information Systems to Enable Business Strategy

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ABSTRACT

The success of any company depends on its competitive advantage — its ability to deliver a product at lower cost, with better quality, or with unique services. Whatever plan enabling its information system, the company's business strategy can make the difference between struggling to stay up or creating a favorable competitive situation. This paper describes the conception, development, implementation, and impact of information systems at a manufacturing company (referred to as "The Company") that forges the link between making and carrying out strategy. The systems combine the power of current database and systems development technologies with intelligent system concepts.

INTRODUCTION

In the MIS literature, there are general approaches for developing information systems that enable the organization's business strategy. Rackoff, Wiseman and Ullrich [10] describe a five-phase planning process to identify and evaluate Strategic Information System (SIS) opportunities. Porter and Millar [9] provide a framework for analyzing the strategic significance of new information technology. They specify five concrete steps, or assessments, that managers can make to determine the strategic impact of IS on their companies. Johnston and Carrico [5] emphasize that leading the organization toward competitive advantage through the use of IT involves: (1) building a knowledge base; (2) conducting the search for opportunities; and (3) developing and managing the initiatives as a change process. Benjamin, Rockart, Scott Morton and Wyman [2] propose a strategic IT opportunities framework for senior management. Similarly, Parsons [8] presents a multilevel framework for assessing the competitive impact of IT on a firm. He then provides a guide for integrating information systems with the firm's strategy. Bakos and Treacy [1] survey previous major attempts to arrive at frameworks which relate the smooth coordination of technology and corporate strategy.

In addition to general frameworks to guide the application of IT to an organization's competitive advantage, there are specific examples in the literature of information systems and information system planning methodologies which have successfully captured a competitive advantage. For example, Clemons and Row [4] describe the utilization of Economost, a strategic information system within the McKesson Drug Co. Economost is an order entry and distribution system wherein nearly 100 percent of McKesson's orders are entered electronically by its customers. Clemons and Row describe the favorable and dramatic impact of the system on McKesson's customers and its costs. Major competitors quickly developed similar systems. As another example, Cash, McFarlan, McKenney and Vitale [3] describe the American Hospital Supply Corp.'s ASAP System as another classic example of the implementation of a strategic information system to gain competitive advantage.

In addition to specific strategic information system applications, Lederer and Sethl [6] discuss strategic information systems planning (SISP) methodologies as the process of deciding the objectives for organizational computing and identifying potential computer applications which the organization should implement. Lederer and Sethl then illustrate their definition of SISP with three specific methodologies. The Business Systems Planning (BSP) SISP methodology hinges on a firm's business mission, objectives and functions, and how these determine its business processes. These classes are analyzed for their data needs, and data classes identified. Strategic Systems Planning (SSP) defines a business function model by analyzing major functional areas. A data architecture is then derived from this model. Information Engineering (IE) provides techniques for building enterprise models, data models, and process models which form a comprehensive knowledge base to create and maintain information systems.

The Strategic Applications Group

Recognizing that "The Company" was not responsive enough to its changing customer demands, top management decided that better customer transaction information was

required and established a task force to study the information systems' current state and make recommendations for addressing current and future information system needs. The task force determined that lack of integration, at both the data and process levels, was a significant problem leading to high cost, low information integrity, low functionality, and low information accessibility.

The task force identified two distinct classes of applications:

Internal: those that do not have direct impact or potential linkages to customers and suppliers.

Strategic: those that could impact the customer's perceived added value of doing business and provide market differentiation.

While it was appropriate to buy integrated application packages for internal applications, the task force decided it was more important to build strategic applications that would give The Company the flexibility to differentiate their business from competitors through special business arrangements and services. Strategic applications must reflect specifically how The Company does business and be able to change quickly to meet changing business needs.

As a result of the study, the Strategic Application Group (SAG) was established to implement the recommendations of the task force. SAG is positioned outside the MIS function and reports directly to the Vice President of Administration. It contains all critical functions for defining and developing strategic business applications: business planing/modeling, data administration, and systems development. Operational and support functions — such as installing and maintaining system hardware and development software — are provided by the MIS function.

To date, SAG has developed and implemented a new set of applications which meet The Company's requirements for customer master agreements, sales manuals, and order entry functions. These applications permit a prospective customer to enter into a binding agreement with The Company directly on their own initiative, providing that their proposed terms are in consonance with The Company's business strategy rules.

These applications support The Company's business strategy by: 1) Providing a set of capabilities which vastly reduce processing time, costs, and improve customer satisfaction; 2) enhancing the firm's ability to conduct business activities in close proximity to the customer, with adequate security to enable customers to perform many of these functions directly; 3) enhancing the customers' perceived added value of doing business with The Company by providing faster delivery of products and services; and 4) bringing a higher overall function and quality in The Company's business transactions and service activities.

The Customer Information Systems Model

Typically, strategy filters down to the front line (customer interface) through various levels of the organization. At each level it is reinterpreted by individuals with different agendas. By the time it gets to the front line it is distorted, or worse — wrong. Even it it's still right (as a function of time and the dynamics of the marketplace) it may no longer be relevant.

Traditional software engineering methodologies, like those outlined by Zachman [11], promote the development of process-oriented business systems that merely automate this bureaucracy. What The Company needed, to become more responsive, was an information system that embodied business strategy and allowed changes to be communicated quickly and with little distortion to the front line.

The decision to link information systems to business strategy stemmed from the objectives of SAG. One objective was to establish a new base for tactical business applications. Another was to improve application development productivity to reduce costs and to hasten delivery time. A third objective was to enhance the friendliness and functionality of existing tactical systems, and a fourth was to establish a base to use information technology to gain competitive advantage in the industry.

With this in mind, SAG's first challenge was to create a customer information systems (CIS) model which reflected the essence of customer transactions — not just the processes of conducting business with customers. The resulting CIS model can best be described as three integrated components: a business model, an enterprise model, and a business systems model (Figure 1).

Together, the business and enterprise models represent the state of business and how business is conducted. The business model describes business activities in terms of objects, associations between objects, and values of object attributes.

Business objectives are accomplished through the enterprise model rules. For example: XYZ Corp. issues a purchase order for 300 widgets at $400 each. The enterprise model describes the business integrity rules which govern business activities. In the example, these rules might offer a 5 percent discount if payment is made within 30 days after the widgets' delivery. The purpose of this enterprise model rule is to encourage rapid payment of accounts receivable to help The Company meet short term revenue projections.

On review, some of the enterprise model rules are successful in helping The Company meet business objectives; others are not. Therefore, some ways of doing business should change. With an enterprise model, only a change in the appropriate business integrity rules is required (such as the above example offering discounted timely payments). A third

model — the business systems model — is required, however, for governing changes to these rules.

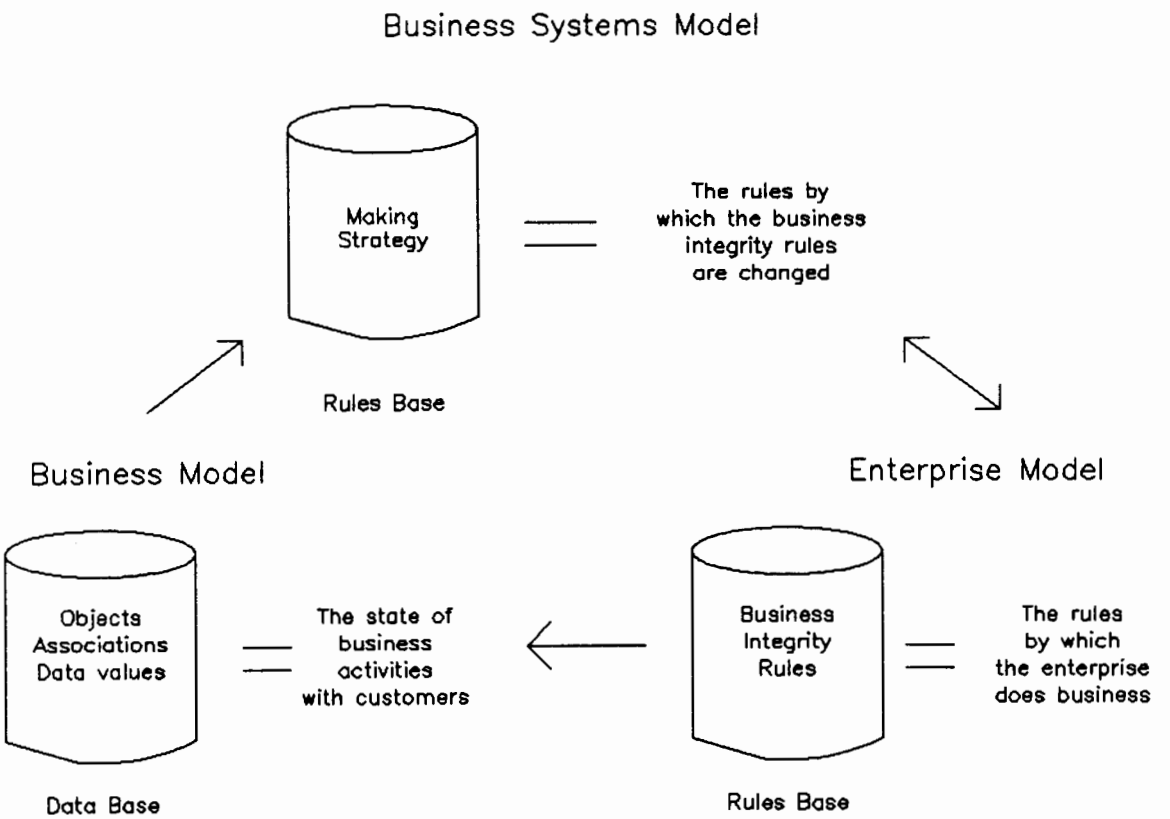
The business systems model reflects the performance of business activities and allows management to improve it by changing the business integrity rules that govern those activities. Rules to govern business integrity are stored in a "making strategy" rules base. Strategy is embodied in the rules so strategy changes merely involve changing the business systems model rules.

For example, consider the change in strategy rules which encourage rapid payment of accounts receivable to help meet short range revenue projections. If The Company decides that extending credit to increase overall sales is more important than meeting short term revenue projections, the "making strategy" rules base will be modified, allowing commensurate changes to the business integrity rules (in the enterprise model rules base). As a consequence, the new strategy is communicated through the business automatically and governs all transactions with customers. Thus, strategy is integrated with actual business activities.

Systems Development Architecture

SAG is responsible for designing and developing strategic applications using highly productive and flexible tools. Once developed, individual systems migrate to a COBOL production environment under the responsibility of the MIS function. The systems development architecture to support SAG has two primary components: systems architecture and application architecture.

Figure 1. The Customer Information Systems Model



Systems Architecture

The systems architecture is designed around off-the-shelf hardware and software technologies that provide as much function and flexibility as possible. The architecture consists of data communications, data base, and rules base functions.

The data communications function provides structure

and form to application/display terminal and printer interactions. CICS was chosen as the data communications monitor because of its ability to provide excellent device support and because of its high performance characteristics.

The data base function provides structure and form to applications/stored data interactions. The development strategy requires the power and flexibility of a strong relational data base management system.

The rules base function provides structure and form to applications/stored rules interaction. The CIS model identifies rules governing business activities and rules which change these rules. Unfortunately, system support for a rules base separate from applications has not been developed at a level comparable to that for data bases. As a result, for example, IF-THEN strategy rules for The Company are directly and redundantly coded into each separate application making use of that particular rule. Eventually, the rules base will be segregated and accessed to generate application functions much as the dictionary is accessed for data-related information.

Application Architecture

All applications have the same overall structure (Figure 2). Each data base relation is surrounded by kernels that provide the primary function and access to the data in the relation. Kernels are implemented as commands which act on objects and associations. These commands are defined in the same terms and have the same meaning as business activities affecting real world objects and associations. Thus, they model the business.

Veneers rely upon kernels to perform modifications to data base relations. When a veneer calls a kernel, it passes data gathered from the operator or other sources. Veneers are of two forms: a menu, which allows operators to navigate from one function to another, and a higher level command which performs an aggregate of kernel activities. This allows higher level business functions to be modeled in the same system. (Such a function might be "Take an Order.") Veneers are tailored to specific operator populations and daily tasks. Different populations have different veneers.

As illustrated in Figure 2, the amount of work necessary to develop these building blocks (kernels and veneers) is high, but fairly stable across requirement changes. On the other hand, the description of screens and reports (using advanced software tools) requires a low key effort but is fairly volatile across requirement changes.

Systems Development Methodology

The systems development methodology is founded on the principal that the biggest task in building large applications is the communication of requirements from the user population up to management and across to the developers. This communication is optimized through a standard definition of terms which have consistent meaning to all three populations. These terms describe objects, associations, and values in the real world. Information systems must model the real world to support business requirements. If the same terms are used in the systems as those used in the requirements definition, there is much less work to be done in actually translating requirements into code.

The major SAG players in the development process are:

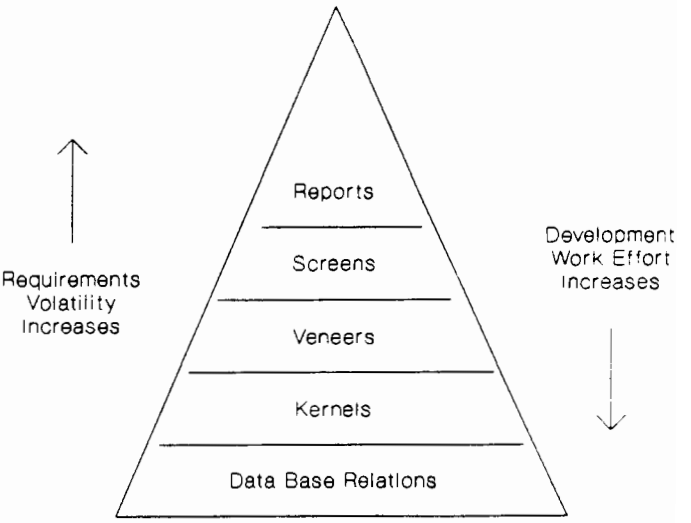
Architects - document requirements to the extent that objects, associations, and values are clearly defined and documented using terms acceptable to all audiences.

Administrators - translate requirements into transaction and data designs which conform to the overall integrated system architecture.

Developers - apply program models to the designs.

Information Analysts - translate client information requirements into reports and charts.

Figure 2. Application Architecture



The following special reports are generated during the development process:

1. The Functional Requirements Report is a high-level, management-oriented description of the function that defines the overall scope of the requirement and its justification; specifies the quality, performance, and auditing requirements; and identifies dependencies upon other functional areas regarding development and implementation of the function and provides an early warning regarding management issues.

2. The Functional Objectives Report is also a high-level, management-oriented description of the deliverables that defines the functional content of each release and its cost;

describes the system execution environment, the development methodology, tools, and standards to be used; and specifies the quality measurements to be implemented and the performance and auditing characteristics of the deliverable.

3. The Veneer Specifications Report establishes the requirements to provide function at the operator level and forms the basis for developing code. It provides operator usage scenarios on a task-by-task basis to specify exactly what function is required and how it will be used and specifies the business justification for providing the function to the operator population.

The specific development methodology used in the development of CIS is a company-unique approach. Complete disclosure is protected by The Company. However, the following is the overall development process flow:

1. Architects work with the client to define and document functional requirements. The architect and the data administrator hold work sessions to gain a complete understanding of the objects, associations, and values involved. A standard set of terms is established to identify these items. The results are documented in the Functional Requirements Report.

   The architect is responsible for obtaining all necessary approvals for the Functional Requirements Report and insuring that complete communication has occurred with all affected areas outside the client organization.

2. In conjunction with MIS, administrators develop a Functional Objectives Report which describes the content and characteristics of the deliverable. The architect is responsible for obtaining client approval of this document.

3. Architects work with the client to jointly define veneer specifications. The architect is responsible for managing a walk-through process and resolving any cross-functional issues identified during this process. The results are documented in the Veneer Specifications Report.

4. A data administrator completes the definition and implementation of the data architecture in the system and builds a test data base,.

5. Developers work with the client to jointly define veneer screens and interfaces necessary to support the application.

6. An information analyst works with the client to jointly define the reports necessary to support the application.

7. Developers complete coding and testing of the kernel and veneer transactions.

8. Architects work with the client with implementation of the system.

One by one, new applications are being developed and implemented using the CIS model as a conceptual guideline and the development methodology described above. Once the old data was restructured for use in the new database, systems that used to be developed in two years have been brought up in a few weeks.

CONCLUSION

Implementation of the system is by no means complete. Specifically, the system is complete with respect to the following business processes and services: order processing; agreement negotiation; sales manual; pricing; customer service dispatch and problem management; and invoicing. On the other hand, the system is still incomplete with respect to: product configuration; shipped asset management; product scheduling; and shipping and export.

However, as the systems are being phased in, managers are realizing the effects on strategy. For example, part of The Company's strategy is to differentiate their product from the competitors. An important facet of their "produce," in the customers' eyes, is customer service. CIS enables more direct dealings with — and responsiveness to — the customers. CIS thus facilitates the division of the amorphous category of customer service into technical specialists to handle product specifications, and business specialists to handle other transactions associated with the order. This restructuring is right in line with the company's differentiation strategy and reinforces the recognition that customers do not buy products — they buy solutions.

In summary, there are several interesting and unique aspects of The Company's approach to systems development which highlight the contribution of this case study to understanding how IT can enable strategy. For example, it is interesting to note that the pre-SAG task force initially began the process by identifying existing information systems applications which were: (1) internal; and (2) strategic. Thus, they determined strategically important applications "up front." In addition, The Company's case illustrates the unique implementation of a rule-based application to negotiate agreements with customers. Moreover, The Company's application architecture is unique (see Figure 2) in that all applications have the same overall structure of data base relations surrounded by kernels and veneers which collectively model the business. Finally, The Company's development methodology is unique and specifically designed to facilitate the communication of requirements across the major players.

In business, we have learned that terms and conditions are as much a part of the product as metal and glass. The business opportunity here for differentiation was pointed out by Ted Levitt of Harvard Business School [7], in his explanation of the massive hidden service sector in a manufacturing industry. All the pre- and post-purchase servicing in the form of system

planning, pre-installation support, software, repair, maintenance, delivery, collection, bookkeeping, and the like, are ultimately parts of the product. Because of the new systems, The Company is getting a better handle on the service part of its total product, and this represents a clear strategic advantage.

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Acknowledgement

This study was funded in part by a grant from the Institute for Information Systems Management (IISM). Sponsored by the College of Business Administration at the University of South Florida, IISM is a center for research, education, and professional networking that helps companies compete in the "Information Age."