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Strategic Data Planning: Lessons From the Field

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Abstract

In spite of strong conceptual arguments for the value of strategic data planning as a means to increase data integration in large organizations, empirical research has found more evidence of problems than of success. In this paper, four detailed case studies of SDP efforts, along with summaries of five previously reported efforts, are analyzed. Fifteen specific propositions are offered, with two overall conclusions. The first conclusion is that SDP, though conceived of as a generally appropriate method, may not be the best planning approach in all situations. The second conclusion is that the SDP method of analyzing business functions and their data requirements may not be the best way to develop a "data architecture," given the required level of commitment of talented individuals, the cost, the potential errors, and the high level of abstraction of the result. These lessons can aid practi-

tioners in deciding when to use SDP and guide them as they begin the process of rethinking and modifying the SDP to be more effective.

Keywords: Strategic data planning, data integration, data management, data administration

ACM Categories: H.2, H.2.1, H.2.7

Introduction

Among many managers there is an increased appreciation for the role of data in meeting the challenges of today's business environment. Access to data from various organizational subsystems is often required to respond to the demands of an increasingly competitive global marketplace. Yet many large organizations today are finding that even if they can access data from multiple functions, the lack of logical data integration (common data definitions and codes) across information systems makes it difficult or impossible to answer cross-functional or cross-divisional questions. This reduces their ability to take advantage of potential opportunities or respond to business problems (Gartner Group, 1990).

The lack of logical data integration is generally believed to be a result of the way systems development has been conducted. IBM (1981) notes that systems have typically been developed within a functional area, with little regard for how those systems or the data they use can be shared across functional areas to better support the business's information needs.

Strategic data planning for improved data integration

One way to address the problem of insufficient logical data integration is to design systems with the total organization's information needs in mind. This philosophy is embedded in the management perspective and collection of methodologies called "information engineering" (Finkelstein, 1981; Hackathorn and Karimi, 1988; Martin, 1982; 1986). Information engineering is based on the assumption that a relatively stable group of data entities lies at the center of an organization's information processing needs. "Strategic data planning," or SDP, is a planning methodology that fits within the general informa-

tion engineering umbrella and addresses two critical phases—organizational analysis and the strategy-to-requirements transformation (Hackathorn and Karimi, 1988). Within the information engineering perspective, SDP is considered an important first step in attaining logical data integration.

SDP is a formalized, top-down, data-centered planning approach that builds a model of the enterprise, its functions, its processes, and its underlying data as a basis for identifying and implementing an integrated set of information systems that will meet the needs of the business. The SDP approach can be distinguished from other information systems planning methodologies by its focus on defining the underlying shared data used by the organization's many functions, and by the definition of a "data architecture" to guide future systems development efforts (Lederer and Sethi, 1988). Two examples of the approach are James Martin's (1982) *Strategic Data Planning* and IBM's (1981) *Business Systems Planning (BSP)*. Appendix A describes the general SDP methodology.

The importance of strategic data planning is evident from the literature. In recent surveys of senior IS executives, improving IS strategic planning is consistently rated as one of the top three issues facing IS organizations (Brancheau and Wetherbe, 1987; Dickson, et al., 1984; Niederman, et al., 1991). In fact, the top three issues in the most recent survey (Niederman, et al., 1991) are all closely related to strategic data planning: developing an information architecture, making effective use of the data resource, and improving IS strategic planning.

How successful is SDP?

In spite of strong conceptual arguments for the value of the SDP approach (e.g., Appleton, 1983; Kanter and Miserendino, 1987; Martin, 1982), the strong interest expressed by senior IS executives, and the use of SDP in many organizations, empirical research has found more evidence of problems than of success (e.g., Goodhue, et al., 1988; Hoffer, et al., 1989; Lederer and Sethi, 1988).

This uncertain success record raises the question of whether SDP is universally appropriate. If success is somewhat problematic, are there lessons that can be drawn from actual organizational experience? Where earlier research on

SDP has tended to focus on understanding possible "pitfalls" with an eye toward clearing the road to SDP success, this research takes a step further back and examines the general appropriateness and effectiveness of SDP approaches in the context of an organization's intended planning objectives. The paper uses the evidence of nine case studies of SDP efforts conducted at MIT and the University of Minnesota, four of which are reported here, and five that were originally (partially) described in Goodhue, et al. (1988). These rich descriptions suggest 15 propositions about SDP that can guide practitioners in deciding when to use it and guide researchers as they begin the process of rethinking and modifying SDP to be more effective.

SDP in the Literature

Based on their personal experiences with 12 SDP planning efforts within AT&T and on the planning literature, Hoffer, et al. (1989) identify over 50 potential pitfalls of strategic data planning, grouped into five categories. They argue that planning efforts often fail because of such pitfalls as an inadequate long-range perspective, insufficient resources committed to the planning process, lack of appropriate methods, and failure to link business modeling with data modeling. Hoffer, et al., suggest that future researchers reduce the many pitfalls they identified into a "few root causes" (p. 356).

Lederer and Sethi (1988; 1991) surveyed IS executives, obtaining 80 usable responses from medium and large organizations involved in IS planning (predominantly using SDP methodologies). They asked respondents to rate the extent to which they encountered each of 49 potential problems (similar to Hoffer, et al.'s, pitfalls), for example: Was the planning exercise very long and expensive? Was the final output document not very useful? Did the output fail to determine an overall data architecture? The respondents indicated moderate dissatisfaction with the resource requirements and high dissatisfaction with the final execution of the plans. The two most critical problems in final execution of SDP plans were found to be: difficulty in obtaining top management commitment for implementing the plan and lack of sufficient detail to implement the plan. Lederer and Sethi (1988) suggest that organizations may commit insuffi-

cient resources to complete and implement their plans. They conclude by raising the possibility that SDP methodologies might be too expensive for the value delivered.

Taking up Hoffer, et al.'s suggestion to find the "few root causes" of problems associated with SDP, Lederer and Sethi (1991) use an exploratory factor analysis to identify five categories of pitfalls. They find that three of these categories have significant power in predicting whether respondents would rate their planning efforts as successful. Specifically, when an SDP does not pave the way for implementation, address data architecture and data administration needs, or take into account organizational goals and strategies, it is more likely to be viewed as unsatisfactory. These pitfalls might be viewed as critical success factors for the methodology, with the implication that they are often not achieved.

Goodhue, et al. (1988) conducted a series of 31 case studies that were designed to examine a variety of data management issues. During this effort, the researchers found five cases of SDP. None of them was completely successful, and three of the five were never implemented. These authors observe that "for many firms, the approach is too expensive, its benefits are too uncertain, and it is organizationally difficult to implement" (p. 383). They also note that SDP requires key managers to commit substantial time and effort; the business may change during the long planning process; and the specific product of the SDP effort is not always articulated, making it difficult to manage the expectations of both participants and top management.

Sullivan (1985) looked at the factors that contribute to success in IS planning in general (rather than SDP specifically). He found that, at least among 15 firms that rated themselves as effective planners, the appropriate planning methodology depends on the degree of IS decentralization (system diffusion) and the extent to which technology use is strategic (system infusion). For example, IBM's BSP (an SDP approach) is considered the right choice when systems are strategically important and centrally controlled.

Summarizing the literature

Some of the studies mentioned in this article are positive about the SDP method, cataloguing the various pitfalls with the goal of removing

obstacles to SDP success. Others question the efficacy of the approach by pointing out the great expense and the lack of implemented plans. However, implicit or explicit in all the studies is the fact that a great many SDP efforts run into serious problems.

This leaves the MIS community in an uncomfortable situation. On the one hand, there are increasing business pressures to integrate data in large organizations; SDP has a strong conceptual basis as a means of addressing this need; there is high interest on the part of IS executives for this type of planning methodology; large investments have been made by individual firms, consultants, and academics in SDP methods; and organizations continue to employ the methods. On the other hand, SDP does not appear to work very well.

Research to date has not given rich enough descriptions of SDP's problems and their context to assist in either modifying the method or replacing part or all of it with a new approach that does not suffer from the same shortcomings. It is time for what Argyris (1982) calls "double loop" learning; that is, step further back, question assumptions that may be controlling perceptions, and begin the process of rethinking this major IS planning methodology.

We began with the analysis of the cases and focused on what SDP efforts deliver, what they cost, and what issues are encountered during the planning process. This required being specific about the intended outcomes and determining, as far as possible, whether such outcomes occurred.

Possible outcomes from an SDP

There is considerable literature about the goals and benefits of IS planning in general, and SDP in particular, which can be used to develop a categorization of positive outcomes from such efforts. For instance, McLean and Soden (1977) cite IS planning goals of improved communication with users and top management, better allocation of resources, identification of IS department improvement opportunities, and identification of new and higher payoff applications. Pyburn (1983) suggests hardware and software architecture, identification of new IT opportunities, prioritization and evaluation of projects

and resources, and forging a link between IS and business strategies. Lederer and Sethi (1988) conclude that the primary objectives of IS planning include: improved communication with users, increased top management support, allocation of resources, identification of high payback applications, and development of an organization-wide data architecture. Martin (1982) notes that the goal of strategic data planning efforts is consistency of information across all systems—in other words, a set of logically integrated systems. He also suggests that strategic data planning can lead to a rethinking of organizational procedures and devotes a chapter of his book to the “corporate reorganization” that can be spurred by realizations of the shared data requirements of the organization.

Synthesizing information from these sources, we developed the following five general categories of potential outcomes.¹ The extent to which organizations engaging in an SDP achieve some subset of these objectives, compared to the costs of the SDP, provides the basis for a case-by-case assessment of the success of each effort.

1. **Implementation of Integrated Systems.** The SDP could produce a detailed plan that would lead to the implementation of a set of subject databases and applications *integrated* across the target domain of the planning effort, to be built in the near future (Martin, 1982). This would probably involve rewriting (or writing for the first time) all systems within the target domain of the planning effort.
2. **Data Architecture.** Though many authors (e.g., Hoffer, et al., 1989; Lederer and Sethi, 1988; 1991; Pyburn, 1983) have argued that a goal of strategic data planning is to develop an architecture, the term “data architecture” is not well-defined. In this research, we define it as a set of constraints on the system development process that ensures a desired level of data integration (data definition and value consistency) in all future systems development or maintenance activities. Thus, data architecture as an outcome is distinguished from the implementation of integrated systems (outcome #1) in terms of the time elapsed and the process leading to the final outcome. There might be no immediate

¹ This categorization of outcomes from an SDP is also based in part on attempts to conceptualize the outcomes of the five SDP cases originally reported in Goodhue, et al. (1988).

implementation, but the data architecture would provide a framework of standards and guidelines within which all new systems and revisions to old systems would be designed, gradually moving the firm toward a set of integrated applications and databases.

3. **Identifying Systems Priorities.** SDP could identify and prioritize a selection of applications to be built in the near future that help the organization meet its business objectives. This goal might include targeting a small number of high payoff applications or deciding on how to allocate resources among identified projects (Hoffer, et al., 1989; Lederer and Sethi, 1988; 1991; McLean and Soden, 1977; Pyburn, 1983).
4. **Rethinking Business Processes.** Given that SDP involves the identification of business processes and data, there is a potential opportunity to creatively rethink critical business processes, allowing innovation and streamlining of some processes and possible elimination of others that are no longer essential (Martin, 1982).
5. **Education and Communication.** SDP could foster better understanding of the critical role of shared data in the organization and the necessity of coordinating across organizational groups in systems and database design. It could also help link IS strategy with the overall business strategy (Lederer and Sethi, 1988; 1991; McLean and Soden, 1977; Pyburn, 1983).

Research Approach: Studying a Poorly Understood Phenomenon

The use of case studies

There seems to be a gap between the expectations about strategic data planning and the results organizations are experiencing. This suggests that the mental models used to understand the phenomena may be missing some critical aspect or that assumptions underlying those models may not be valid. The poor success rate of strategic data planning suggests that SDP and its role in organizations may be more complex than has been thought. If a richer conceptual

model of SDP in organizations is needed, and if researchers need to do more than identify additional pitfalls and the means of avoiding them, then they may need to adopt a methodology that encourages "ambivalent conceptual orientations, ambivalent inquiring practices, and varying positions on the issues" (Weick, 1979, p. 63) as a way of updating their mental models.

Thus, a case study methodology seems appropriate for several reasons. First, case studies provide the opportunity to elicit the subtle and rich data needed to increase the understanding of a complex organizational phenomenon (Benbasat, et al., 1987; Yin, 1984). Second, in contrast to research methodologies such as surveys, case studies lower the risk of focusing on the wrong issues or variables (Weick, 1979). Surveys only get answers to the specific questions that they ask; case studies are more receptive to information not specifically sought. Third, when studying such an important organizational issue, it is desirable for the research community to utilize multiple methods. Thus, the case study approach complements the surveys, literature reviews, and conceptual work of other researchers, as Hoffer, et al. (1989) recognized in calling for additional field research.

Research design

The approach taken in this study was to reconstruct the histories of a number of SDP efforts from initial motivation to final outcomes and to identify relevant factors that contributed to the final outcomes. Five of the 31 case examples from the study reported in Goodhue, et al. (1988) address SDP efforts and provide useful but not necessarily complete information about those efforts. Brief descriptions of these five cases are reported in Appendix B because they contribute to the accumulated case experience with SDP. Four new studies were undertaken, specifically targeting recently completed SDP efforts in three organizations. Table 1 shows the organization and the planning domain sizes for each. Brief descriptions for each case appear in the next section of this paper. While the paper draws on the full set of nine cases for its findings, most of the insights and the sense of the findings are well illustrated by the write-ups of the four new cases.²

The nine cases represent six different industries and a government agency. While they were

chosen as a convenience sample, there was no bias toward either successful or unsuccessful planning efforts—firms engaged in interesting data management practices or SDP efforts either made their interest known to the researchers or they were pointed out by other interested practitioners. Furthermore, informal discussions with IS practitioners who participate in the University of Minnesota's MIS Research Center and MIT's Center for Information Systems Research programs suggest that the experiences and outcomes reported here are representative of many organizations. The research methods used in the five earlier cases are described in Goodhue, et al. (1988). The methods used in the four new cases are presented in this paper.

The primary data collection method was semi-structured interviews, occurring eight to 18 months (average of 13 months) after the completion of the SDP effort. (Some more recent follow-up interviews have added new information on outcomes.) Open-ended questions solicited information on background and organizational context for the SDP, the original motivation for the effort, specifics about the methodology, organization factors affecting the effort, final products, and perceptions of success. Three groups of individuals within each organization were interviewed: those responsible for maintaining and facilitating the planning methodology, those involved in individual planning efforts, and business personnel affected by the plans. A sample of the interview questions for each of the three types of respondents is shown in Appendix C. Table 2 shows the number of each type of respondent for the four cases.

In addition to the interview data, researchers also reviewed other available documentation including internal memos, presentation overheads, the plan outputs, descriptions of the planning methodology, mission statements for the organizational units (including the planning group), and job descriptions for positions created as a result of the planning effort. Finally, for the two case studies conducted at Ventura Products,³

² The number of research sites agrees with Eisenhardt's (1989) observation that four to 10 case studies are appropriate during theory-building efforts. She notes that it is difficult to generate theory with fewer than four cases and difficult to manage the volume and complexity of the information with more than 10.

³ All organizations and individuals have been disguised.

Table 1. Demographic Information

Org Name	Government or Private	Size of Organization	Scope of Planning Effort	Size of Planning Domain (# of personnel)
LSA	Government	Operations & maintenance budget over \$500 million	Org-wide	25,000
Ventura Finance	Private	Revenues over \$1 billion	Division	1,000
Ventura SSD	Private	Revenues over \$1 billion	Division	1,000
Cedar	Private	Revenues over \$1 billion	Division	4,000

researchers studied videotaped focus group sessions in which planning team participants were asked to comment on their general impressions of the planning methodology, ways to improve the methodology, specific problems they encountered during the planning process, and difficulties with plan implementations.

The next section briefly presents the four new cases. The descriptions do not attempt to tell the entire story, but rather they introduce the organizations, describe the motivations for the SDP efforts, present highlights from the planning process with a focus on the issues encountered, and discuss the outcomes.

The Case Studies: Four Short Histories

Case #1: Logistics and supply agency

Background

The Logistics and Supply Agency (LSA) is a federal government agency that furnishes spare parts and consumables to other agencies. In this role, LSA provides two major services. The first is coordinating the logistics of shipments between contractors and agencies; the second is contract administration.

LSA employs over 25,000 people, with an annual operations and maintenance budget of over \$500 million and an annual stock fund budget of over \$4 billion. More than 35 groups report to the LSA director, who reports to an assistant secretary of a cabinet-level department.

Most of the information systems at LSA have been developed to address specific and sometimes narrow operational needs and have not been developed with data sharing between applications in mind. There are, however, some standard systems and data, and a single standard requisition form. A single agency-wide system processes over 15 million requisitions a year. A second agency-wide system, implemented between 1986 and 1988, administers 200,000 contracts. As a result of these common systems, both part number and contractor are standardized and shared on all systems.

Even though LSA has implemented a few agency-wide standards, systems development remains quite decentralized. One early planning effort attempted to coordinate and prioritize requests for new systems on an agency-wide basis. The functional groups, which felt they lost the ability to support their own needs, resisted the process. After a two-year existence, the Agency-Wide Application Development List was replaced by a series of discussions between the director and each functional group on priorities in that area. Thus, the interdependent, "agency-wide" nature of systems prioritization has been removed, giving functional areas more decentralized control over their systems.

Motivations/Goals for the SDP

A second planning effort at LSA, the focus of this study, had its origin in 1979 when IS requested sizeable funds to upgrade its computing facilities. Authorization was given, but LSA took no action because of internal disagreements about the degree of centralization of the new hardware. In

Table 2. Number of Respondents by Type

Organization for Method	Individuals Responsible	Planning Participants	Individuals Impacted by Plans
LSA	3	5	5
Ventura Finance	2*	3	1
Ventura SSD	2*	6	2
Cedar	3	2	3

* Finance and SSD are two units within one large organization. In this organization, there is one centralized group responsible for the SDP methodology. The same two individuals from this group were interviewed concerning both the Finance and SSD planning effort.

1983 the authorization was withdrawn based on the argument that the request for funds should be functionally driven and that the organization, not simply the hardware, should be modernized. IS made several attempts to incorporate a functional perspective, but these were criticized as being too technical and too fragmented. In 1985 IS turned to the Plans and Policies group within LSA for help. This group initiated a strategic planning process using a methodology derived from Martin's (1982) approach. The objective was to plan (and then to implement) a set of integrated systems across the agency.

Highlights of the Planning Process

Early in the planning process, 17 business areas were identified. Of these, nine were classified as essential to LSA's external mission.⁴ Therefore, nine groups of individuals were formed to analyze these critical business areas and identify their functional data requirements. Each group consisted of 12 to 15 people, with a full-time commitment of about 10 weeks (see Table 3).

Data modeling was by far the largest single component of the planning effort. It used between 70 and 80 percent of the person hours spent on all analysis activities. In fact, some participants worked a considerable number of overtime hours formulating and revising the models. In spite of this effort, some team members felt that time simply ran out before the models were stabilized. There was a concern among participants that the resulting models might not be correct enough or detailed enough to be useful.

⁴The nine areas are: logistics data management, item entry support, supply, acquisition, contract administration, warehousing, transportation, reutilization and marketing, and comptroller functions.

Because of differences in background and understanding in the nine groups, the level of detail and quality of the output (data requirements, data models, strategic opportunities) was not consistent across groups. Because this output was also too voluminous, technical, and detailed for management purposes, a summary set of documents was prepared, written in a non-technical fashion (eliminating all data models) and focusing on the business area critical success factors. These summary documents were then pulled together into an agency-wide Concept Paper, which addressed business initiatives, data support requirements, and system support requirements.

Outcomes from the SDP

The SDP effort was considered successful by its participants. However, the cabinet department to which LSA reports, while praising the Concept Paper as the best document of its type it had ever seen, also criticized it as being too big and complex to serve as a basis for a funding request, and suggested it be broken down into smaller pieces to make it more manageable. Within LSA, some groups have argued that the plan does not provide enough detailed information to serve as a basis for rebuilding systems. Within the functional areas, the Concept Paper has been interpreted as a document that sets functional goals and provides overall direction for LSA systems. Each of the functional areas, however, is in the process of designing and implementing modernization efforts in its own area, without any centralized coordination.

Two years after the final Concept Paper was completed, the Policy and Plans group that cham-

Table 3. Time and Cost Estimates for the SDP Efforts Studied

Organization	Number of Participants	Percent of Full Time	Duration	Estimated Cost*
LSA	9 teams of 12-15 each	100%	10 weeks	\$1,900,000
Ventura Finance	15	50-60%	9 months	500,000
Ventura SSD	15	50%	9 months	450,000
Cedar	10	100%	1 year	800,000

* Costs are estimated by assuming an average salary of \$40,000 and overhead and fringe benefits of 100%.

pioned the SDP continues to struggle to keep its vision of totally integrated databases alive. Funding to bring all the data models from the original SDP to a uniform level has not been forthcoming. In an effort to demonstrate the benefits of shared data, the SDP group has focused on a specific project—a contractor information system. After great difficulty with funding and staffing, they are finally off the ground. However, the fate of the project is unclear because the champion of the SDP effort is set to retire.

The next two case studies were conducted at Ventura Products: one in the Finance division and one in the Support and Service division. Ventura Products is a *Fortune 500* firm that manufactures and distributes consumer, health care, and industrial products. The firm has annual sales exceeding one billion dollars. Though Ventura is quite decentralized, it maintains centralized control in some areas. Customer accounts and assets are centrally controlled and managed, but the individual divisions are responsible for the development, manufacturing, and marketing of products. Corporate IS (CIS) supports the centralized functions by maintaining a number of core systems, such as billing, accounting, payroll, and purchasing, that are used by all divisions. These core systems and their databases provide standard customer numbers, products numbers, and vendor numbers at Ventura. In addition to the IS support given by CIS, the divisions and large departments have local IS units to develop and support their local IS activities.

As a result of participation in an executive education program (sponsored by both IBM and Ventura) in 1982, Ventura executives bought into the idea of BSP (an SDP methodology) in order to link systems together to address business requirements. After conducting six BSP efforts between 1983 and 1985, Ventura developed their

own planning methodology in an effort to move more successfully from the planning phase to the implementation phase. There is now a formal group within CIS that is responsible for maintaining and facilitating their in-house version of SDP.

Case #2: Ventura finance division

Background

The Finance division at Ventura consists of four departments: Tax, Controller, Internal Auditing, and Treasurer. Finance employs over 1000 individuals, about 60 of whom are IS personnel. Their IS activities are large and complex: as a staff unit, they support the entire Ventura organization. Finance's annual budget for IS exceeds \$17 million.

Motivations/Goals for the SDP

By the nature of their mission, the Finance organization is significantly affected by changes in government regulations, technology, and legal requirements. Partly because of this, their IS organization has traditionally tended to be reactive to day-to-day crises, rather than follow a long-term plan. This has resulted in problems with incompatible data across systems and spiraling costs. Finance's IS steering committee, which included key senior managers from the functional area, realized that they could no longer afford to operate without a long-term vision. They were searching for a way to articulate their future needs so that new systems priorities could be determined, and at the same time to develop some standards and guidelines that would move them toward a more planned environment where resources could be allocated in a logical manner.

After the planning group from corporate IS gave a presentation to Finance on SDP as a solution, the Finance IS steering committee was at first

split on whether to undertake the effort. However, one of the Finance managers on the committee had seen the positive effects of a BSP in his own organization years ago, and he persuaded the group to charter the SDP.

Highlights of the Planning Process

The time and effort statistics of the Finance SDP are shown in Table 3. During the planning effort, the participants quickly realized that the SDP methodology as recommended was problematic for their large organization. The Finance division is a staff function that supports the entire organization. Since the division creates and manipulates so much of the organization's data, following the SDP methodology would produce a volume of information the planning participants could not possibly cope with. They tried to manage the scope of their planning effort by limiting the number of business functions analyzed to 40, but they still had to operate at a much higher level of detail than the SDP methodology called for. As a result, they were not able to identify specific applications for future development or create detailed architectures or plans. Instead, they created two products that might be loosely called architectures. The first was the identification of 11 "logical locations" or groupings of data elements⁵ that provided a conceptual map of the data of the organization and allowed the participants to categorize many actual and potential systems projects in a useful and meaningful manner. The second product was a set of 18 high-level recommendations and development guidelines. The generality and level of detail of these guidelines is indicated by the examples reproduced in Table 4. In addition, the final plan describes, on a broad level, upgrades for existing systems and development of new systems that will enable the division to meet their business needs.

Results of the SDP

With the top level recommendations in place, the expectation is that each department within Finance will carry out its own modified planning efforts, filling in the details of the Finance SDP by identifying and prioritizing specific applications and constructing a data model for their depart-

ment. Finance will then consolidate these plans for the entire division.

While they experienced a number of problems with the methodology itself, the Finance team members cite several benefits from participating in the SDP. First, they believe that money will be saved over the long run because the development of systems will be managed better as the new "architectural" guidelines are followed. Second, the team members note that communication improved between CIS and Finance, and among individual Finance departments. This helped to decrease feelings of provincialism: "Eight directors found out that they are managing corporate data, not their own data. This was a big change in attitude among the directors." Team members believe this increased awareness of data issues in the division as a whole may have important long-term implications for IS initiatives.

Case #3: Ventura support and service division

Background

The Support and Service Division (SSD) is a large service division within Ventura and employs more than 1,000 people in the U.S., including 15 IS employees and 25 IS contractors. This division was created from a number of smaller groups, each with its own IS perspective. From 1979 to 1982, Ventura pulled all of these areas into SSD so that customer service contracts could be managed at the corporate level. It required five or six years to stabilize the division and define its business mission. During this period, IS was not a priority.

Motivations/Goals for the SDP

Once SSD emerged with a clear mission and a business to run, IS was recognized as a critical success factor. Management saw that SSD must shift from a focus on product models and serial numbers to a focus on customers. They explicitly recognized that easily accessible, accurate information about service requests, equipment histories, etc., was critical if they were to succeed. Their existing systems (pulled from various predecessor organizations) did not support this new focus and suffered from important data integrity problems. Thus, there was strong management agreement on the need for new systems to support the new business context.

⁵The 11 logical locations are: consulting, administration, customer related, risk management, auditing, employee related, amortized/depreciated assets, vendor related, inventory, reporting, and finance.

Table 4. Excerpts From Ventura Finance's Strategic Information Plan

Recommendations
<ol style="list-style-type: none">1. We recommend that a data resource manager (DRM) be appointed for the Finance Organization. The DRM would be responsible for integration of data at the organization level.2. We recommend that all future system designs in the Finance Organization consider the following features where applicable: mass update capability, upload/download, special reporting, decision support capability.3. We recommend that documentation and programming standards should be adopted by all departmental IS support groups if they have not already done so.4. We recommend that a Post Implementation Plan be adopted to ensure the continued progress toward the goals established during the SDP process.

Source: Finance Organization Strategic Information Planning Study Final Report, December 1987.

One senior IS manager in particular championed SDP as a means of moving away from a piecemeal development mentality to an environment of planned development, giving SSD the ability to take advantage of strategic opportunities. The specific goal of this planning effort was to develop a set of totally integrated systems to provide the competitive advantage the division needed to succeed in a difficult market.

Highlights of the Planning Process

The time and effort statistics for the SSD SDP are shown in Table 3. During the SDP, approximately 60 business functions and 20 data entities were identified, and a detailed data model was developed. The effort also produced a migration plan for moving from its mixed vendor environment to a single vendor, and the division took one year to validate the technical architecture by prototyping systems. Finally, a Gantt chart prioritizing the upcoming development projects was also created.

Results of the SDP

Two systems will create the bulk of the data used by the division. Implementation of the first of these, the *revenues* system, began soon after the SDP was completed. The revenues project manager acknowledged the value of the work previously done by the SDP. However, he noted that the development team needed to do a substantial amount of rework to create a useable data model because of a number of inaccuracies in the one created by the planning participants. He indicated that a less specific data model at a higher level of abstraction than the one produced by the SDP would have been as valuable: "We are the experts, not the people doing the

SDP. We have to sort out and correct the errors made by the SDP people anyway."

During the development of the revenue system, the SSD division worked hard and long to reconcile the definition and name of each of the system's 500 data elements with the several thousand standard data definitions already on Ventura's corporate data dictionary. This was a major time commitment and required help from the corporate data standards group. In spite of all this effort, SSD's data resource manager believes SSD and the corporate data dictionary have some "near duplicates."

Interestingly, SSD is not following this same process of reconciling with the corporate data dictionary for the development of its second major system, *logistics*, since it required too much time and money for the revenue system. SSD does not feel that the inconsistencies between their systems and corporate data standards will cause them problems.

SSD considered the planning process quite successful and felt the final plan was useful and beneficial. Unfortunately, current business pressures threaten to slow down the implementation of the remaining systems identified in the SDP.

Case #4: Cedar industries

Background

Cedar Industries markets a wide range of products and services to businesses and consumers. Located in the Southwest, the organization is a major player in an industry that was gradually deregulated during the 1980s. As

the industry deregulated, Cedar Industries experienced a major upheaval in its structure, culture, and business. With the reorganization that followed deregulation, many previously separate divisions needed to coordinate in new ways, but incompatible information systems made this impossible. The resulting operational paralysis motivated top management to address the underlying problem as well as solve the immediate crisis.

To help address the problem, both a high-level task force and an outside consulting firm strongly advised appointing an information executive and managing the data infrastructure. As part of these recommendations, divisions within Cedar were encouraged to use SDP in their IS planning efforts. As IS groups were gradually reorganized into a single CIO organization, a special group was established to encourage and assist the divisions in carrying out a new in-house strategic data planning methodology. This methodology was intended to surface the critical data used in running the business; provide a framework, or architecture, around which future systems would be built; and identify key strategic systems.

Motivations/Goals for the SDP

One of the first groups to use this new methodology was the Consumer Services division, which is the focus of this case study. Prior to the industry deregulation, the focus of this division was more on service of existing products than on anticipating and meeting consumer needs. After deregulation, however, the Consumer Services division found itself in a new, competitive environment with a need to focus on the customer and a need to respond to their environment much more quickly. In addition, the Consumer Services division vice president was a strong believer in the importance of managing data as a means to address the upheavals facing Cedar. The specific goals of this planning effort were to create a division-wide data architecture and to identify and prioritize future systems development projects.

Highlights of the Planning Process

The time and effort statistics of the Consumer Services division's SDP are shown in Table 3. One-half of the total time spent (six months) was devoted to developing a very detailed business model containing 16 business functions broken down into 88 processes and 530 activities. For

each activity, the data entities used as input and output were identified. In addition, 20 to 40 different user types were identified, and both the type and location of users were associated with each of the 530 activities. Ten potential projects surfaced as a result of the planning effort, four of which were selected for a more detailed planning phase. Three of the four were ultimately implemented.

Results of the SDP

The SDP has provided this division of Cedar with an architecture that will guide its future systems development. The architecture takes the form of 200 or so "business modules" or groupings of the 530 activities, and 40 data entities. Whenever a new business requirement surfaces, it can be located in the architecture, and Cedar can decide where it is most beneficial to place the process. Instead of building it as a separate isolated process, they might fold it into a major enhancement, so as to build a piece of the architecture.

While this SDP effort was considered a success, fewer and fewer other divisions at Cedar are willing to use the approach. Even the business manager who presided over the successful effort admitted that he probably would not spend that kind of money if he had it to do over again. His primary reason is that the process takes too long, costs too much, and does not seem to produce a much better plan. This sentiment was echoed by several managers responsible for authorizing and funding development efforts in other parts of Cedar.

A number of other concerns were raised about SDP. One manager suggested that the SDP's biggest problem was that it did not focus on anyone's number one problem, that it ended up surfacing everyone's second priority problems. This manager thought the value might be greater for a firm where the IS function is centralized and where it operates in a reactive mode to requests from the business. The educational value to IS in such a firm might make the process worthwhile.

There were several other concerns as well. First, SDP participants become too involved with automating the existing business processes and "take too much for granted" to be able to creatively rethink and redesign the business processes. Second, some critical needs surface early in the SDP process and are immediately

acted upon unilaterally by functional management long before the plan is completed. Thus, with action in progress on some of the highest business priorities, there are fewer compelling arguments for implementing the total program. Third, the ability to communicate the plan to the systems development department may prove problematic. Several of the systems analysts interviewed were not aware of any guidance or constraints on their activities that resulted from the SDP. However, it is possible that these analysts were at too low a level in the organization to be aware of the impacts of the SDP.

Discussion

These four cases (along with the five briefly described in Appendix B) illustrate that a strategic data planning effort is a major, complex undertaking. Table 5 summarizes the outcomes achieved by all nine cases. The boxes mark those outcomes that seemed to be the original goals of the planning process. As can be seen, the outcomes achieved were not necessarily the goals initially aimed for. Four companies began with the goal of implementing integrated systems; only one accomplished it. Two companies wanted to create data architectures to guide systems development. One of these was shelved; the other was not used as originally planned but did lead to important benefits a few years later. The three other companies had the dual goals of creating a data architecture and identifying systems priorities. Each of these three had mixed results.

The reasons why SDP methods are difficult to implement—as suggested by Goodhue, et al. (1988), Hoffer, et al. (1989), and Lederer and Sethi (1988; 1991)—hold true for these companies. There are, however, deeper insights to be gained when the rich and varied evidence of all nine cases is organized around the five “potential outcomes” presented earlier. Because these findings were not hypothesized in advance of the data collection, they are presented as propositions to be evaluated by future research and experience.

Outcome #1. Building totally integrated systems

As Table 5 shows, four of the nine cases explicitly sought to plan for and implement data-integrated

systems over the domain of the planning effort. Only one of these succeeded. What explains the success at Ventura SSD, or the difficulties encountered by the other cases?

For most firms, achieving this outcome in the near term implies developing a data architecture, followed by a nearly total rewrite of all systems within the target domain. For firms desirous of this outcome and willing to pay the cost, Martin's (1982) comment is probably quite accurate: “It would be unthinkable to build a battleship without an overall plan of the whole ship” (p. 1). However, many firms are not prepared to undertake the cost of such a massive rewrite effort to achieve a totally integrated environment, and when they are not, SDP involves them in an expensive process that may not be necessary. As Table 3 shows, all four of the recent case study efforts (where detailed cost figures are available) were quite expensive, typically costing around half a million dollars, and taking from six to 12 months to complete.

Proposition #1: SDP is a design methodology, as well as a planning methodology.

SDP rests on an implicit assumption that all systems in the domain are being redesigned, and it actually starts the process of systems design. This is appropriate when it is true that all systems in the planning domain will probably be redesigned, as was the case at SSD. Where total system redesign is not intended, much of the effort in an SDP goes into what is essentially the initial design of systems that will not be built. Because of this, the SDP methodology is really tuned best for the very ambitious objective of totally integrated systems over the whole planning domain.

Proposition #2: Data integration must be critical to the strategic goals of the organization, as perceived by top management.

This is quite different from suggesting, as others have (e.g., Hoffer, et al., 1989; Lederer and Sethi, 1988; Martin, 1982), that top management involvement is critical. Top management was involved enough in all the cases to fund the planning project (about half a million dollars each for the cases in Table 3) and to give at least nominal support. But only at Ventura SSD did management see data sharing between systems as critical to the success of its strategy. There, strategic data planning, though expensive, was

Table 5. Summary of Outcomes Achieved in Four New and Five Earlier Case Studies
(Original Objectives Are Indicated by Boxes)

Organization	Cost of Planning Effort	Implemented Integrated Systems	Data Arch Guides Syst Dev	Outcomes Achieved				Comments
				Identify Systems Priorities	Rethink Business Processes	Education/Communication		
LSA	\$1.9M		—	Opportunities for functional areas	—	Planning team education	Still struggling to get organizational buy-in	
Ventura Finance	\$0.5M	—	18 high level guidelines; 11 log. locations	—	—	Major division level benefits	Turning point for divisional understanding of IS	
Ventura SSD	\$0.5M	2 key systems underway	Detailed E-R data model	Critical systems identified and prioritized	—	Division level benefits	Textbook success story	
Cedar	\$0.8M	4 systems underway	200 business modules	Identified 10 potential projects	—	Planning team education	De-emphasized SDP based on cost and relative advantage	
Derrick	?	6 databases underway	9 major databases	50 projects linked to required DBs	—	?	Shelved after reorganization; then revised by IS without users	
Nat. Tech.	?	—	—	—	—	?	Shelved	
Waverly	?	—	—	Data model used with CSFs to identify info DBs	—	Data model shared with other divisions	Gradually developing more generalized data model	
Consumers	?	—	—	—	—	Planning team education	Shelved	
Foothill	?	—	—	—	—	Planning team education	Shelved	

considered essential to meet the goals of the organization.

Thus, it is not sufficient to enlist top management involvement, if involvement simply means approval to engage in the planning effort, and allocating individuals and money to that end. Data sharing must be critical to top management's view of the future organization, or "involvement" will evaporate when the true costs become apparent or when some other business issue diverts top management's attention.

Proposition #3: Sufficient control over the planning domain is needed.

An organization must have sufficient control over the planning domain to resolve conflicts among the organizational subunits involved. Whether the resolution is achieved through centralized authority or negotiated consensus, agreements must be forged on the tough design issues that may adversely affect some parties. At Foothill Computer, international groups decided to split off from the integrated effort to develop their own systems, and the SDP proponents had no means to stop them. In addition, an SDP may be perceived as a threat to decentralized power. For example, in the LSA organization, the failure of the Agency-Wide Application Development List was at least partially a result of functional areas resisting a loss of local autonomy and control. The later SDP was allowed to proceed, but its results were quickly co-opted, and the organizational-wide effort never gained momentum.

Proposition #4: Efforts to implement data integration need to balance global integration and local flexibility.

To be accepted by key stakeholders, data integration efforts may need to find the right balance between the value of global data integration versus local flexibility (Goodhue, 1989). At LSA, where there is already in place some "partial" data integration in the form of common definitions and codes for all part numbers and for all contractors, the additional value of more global data integration was not compelling to the decentralized divisions. They preferred rapid local solutions for the issues raised by the SDP, rather than waiting an indeterminate time for a global solution and possibly losing control of the solution's details. One interpretation would be

that the current architecture of "partial" data integration (part numbers and contractor ID's) already strikes approximately the right balance between global and local needs for this decentralized organization. Thus, using SDP to promote extensive data integration in decentralized organizations with unique local needs may not only be difficult, it may not be best for the organization.

Outcome #2. Creating a data architecture

Some organizations will be unwilling or unable to rewrite all systems within the planning domain in the near term. For these, an SDP offers the promise of producing a data architecture to guide systems development so that as new applications are built and old systems revised, the firm will gradually move toward a set of integrated applications and databases. As Table 5 shows, five firms had as a major goal the development of a data architecture to guide systems development (if those who intended to use the architecture to implement specific systems are excluded). Of these five, three succeeded at least in some form. However, these "successes" must be examined carefully, as the discussion below demonstrates.

Proposition #5: It is not clear what the most appropriate form for a data architecture is.

In practice, data architectures can take very different forms. For Ventura Finance, the architecture was 18 high-level guidelines and the categorizing of all its data into 11 "logical locations." At Cedar it was 200 business modules; at Derrick, nine major databases. Although at Cedar and Derrick the architectures guided systems development in some valuable ways, it is not clear what value Ventura Finance's architecture has added. Even at Cedar and Derrick, the form of the architectures is quite different. Perhaps the most appropriate form of architecture depends upon organizational circumstances, but it is not yet clear what form of architecture is best for what situations.

Proposition #6: It is not clear that SDP is the most effective means to produce such architectures.

No matter what the desired form of the architecture, it is reasonable to ask whether an SDP is needed to arrive at that architecture. Derrick was

able to use its SDP derived architecture of nine major databases to recognize that many of the 50 project requests needed the same six databases. However, Consumer Publishers reportedly identified a similar architecture of major databases at a fraction of the cost of an SDP effort. At Cedar Industries, though they realized value from an SDP-derived architecture of 200 business modules produced by an SDP, they considered the SDP too expensive to justify its use in other areas of the company. At Ventura Finance, it would seem possible to identify as useful a set of 11 "logical locations" at far less than the cost of the SDP.

Proposition #7: Too large a scope spells trouble.

Large organizations may have trouble adapting the methodology to their needs. As suggested at Cedar, when the scope is too large, planners may get lost in the crush of detail. When large planning domains are broken into pieces, as at LSA, uneven quality and level of detail may make it difficult to consolidate separate pieces into a single architecture. On the other hand, using the methodology with a less detailed level of analysis, as Ventura Finance did, may result in relatively superficial architectures.

Proposition #8: To have an effect on data integration, architectures must be enforced.

Whatever form the data architecture takes, if systems developers do not conform to it, it will have no effect on implemented systems. For example, at Ventura the corporate data standards effort defined an architecture of several thousand standardized data elements. However, systems developers in the SSD division decided against conforming to this architecture for their logistics system because of the additional local cost. Systems developers at Cedar were not even aware of the architecture in their organization, making enforcement problematic

Proposition #9: Architectures should be "stolen," not reinvented.

Martin (1986) suggests that a basic principle of information engineering should be "steal don't reinvent" (p. 68). This time-honored adage has not generally been applied to data architectures. To the extent that data architectures are stable

over time within a company, they should also be quite similar across companies within an industry. Derrick "stole" the architecture from the production portion of its business, and put several high-level IS analysts in a back room to adapt it to the whole new division, without conducting another SDP. At Waverly Chemicals the data model developed in one division was adopted by another division with minor changes and successful results. There is some indication that the revised data model is of higher quality for both the divisions. Thus "stealing" may not only be less expensive, it may produce better architectures because the stolen items will have been refined by additional time and experience.

Proposition #10: SDP spends too much time bringing novice data modelers up the learning curve.

A substantial portion of the total planning time in an SDP is spent in developing the data model to use as a basis for the data architecture. This data modeling is generally done by team members who are not expert data modelers. Thus, a time-consuming and complex process is made more so by giving it to people who are not expert in the concepts or techniques required. This may provide useful education to team members, but it is not an efficient means of developing a data model. Not only is this inefficient, but it can generate data models of uneven or less than desired quality. The inaccuracies in SSD's data model prompted the systems developers to make major revisions. At LSA, team members quit modeling when time ran out, without feeling that the models were correct enough. In five of the nine cases, team members expressed frustration and confusion as they tried to develop sufficiently accurate data models without a clear understanding of what was required.

Objective #3. Identifying systems priorities

Totally integrated systems and data, in either the short or long term, is not the only possible outcome of an SDP. Another goal could be identifying potential systems projects for the organization and prioritizing these for near-term implementation. Three of the nine cases had this as a goal of their planning processes. Of these, Cedar clearly succeeded, Derrick succeeded in some

form, and Ventura Finance did not succeed. In addition, three more of the cases achieved some value along the lines of this objective. However, SDP may not be an efficient approach for this goal by itself for several reasons.

Proposition #11: For a systems priorities goal, SDP does not narrow its scope fast enough before it begins the time-consuming process of modeling business functions and entities.

If identifying high payoff projects is the goal, the more quickly attention can be focused on those systems or functions that have a critical business impact, the sooner that impact will be evident in the organization's competitive position or bottom line.⁶ Returning to Martin's (1982) metaphor of building a battleship, suppose that rather than building from scratch, the goal is to identify high payoff repair or modernization projects for an existing ship. It is clear that some overall map of the total ship (or of the total data requirements) is critical to understand how the targeted high payoff projects fit into the whole. But where identifying high payoff projects is the goal, relatively less time should be spent on the overall map, so that planners can more quickly focus on critical areas.⁷ Because SDP actually begins the design process of building a totally integrated set of systems (proposition #1), it tends to give each business function and each entity equal weight. When systems for these functions are not going to be built, much of this design effort is wasted.

This was certainly the dilemma faced by Ventura Finance—it made no sense to conduct the data modeling at the level of detail suggested by the methodology since most of these systems were not candidates for rewriting. It may also have been a factor in the large cost of the methodology at Cedar Industries where equal emphasis was put on 530 business activities, without distinguishing between critical and non-critical areas of the business. Thus, to the extent that the primary goal is identifying high payoff systems, SDP may be an inefficient approach.

⁶"Critical Success Factors" (Rockart, 1979) is one planning approach that far more rapidly identifies high payoff projects.

⁷An '80/20' planning approach (Goodhue, et al., 1988) that quickly establishes a rough map of the firm's data would be a far better starting point for targeting critical systems.

Proposition #12: Creativity is swamped by the volume of detail.

The volume of detail required by the methodology tends to swamp individuals' abilities to see the whole picture and fashion creative solutions. At Cedar Industries, the SDP team spent six months analyzing 530 business activities, specifying for each the data entities needed for input, the data entities produced as outputs, the user types, and the locations used. Though the team identified several useful projects after this data modeling effort, user managers felt the projects were "everybody's second priority."

Proposition #13: The time required by individuals may self-select the wrong participants.

Prior research and the cases in this article suggest that the SDP methodology requires a major time commitment from its participants, often as much as half a year of effort. Because the time of the most insightful and capable individuals is usually in high demand, the methodology may self-select the wrong people—those who can be spared because they are not involved in other critical business issues. The result could be less insightful and less creative solutions.

Objective #4. Rethinking business processes

An SDP could potentially engender a new perspective on the way business processes should be carried out by focusing on the shared data of the enterprise (Martin, 1982). This could potentially result in recommendations for significant reorganization and restructuring of the firm. As Table 5 shows, none of the planning efforts reported here had this as an explicit objective, nor achieved the outcome of rethinking key business processes. The difficulties associated with meeting this objective would seem to be similar to the problems associated with identifying systems priorities (objective #3). Rethinking critical business processes requires managers with a keen understanding of both the organization and the business environment and an ability to see beyond current ways of operating—exactly the kind of person unable or unwilling to spend major amounts of time doing detailed modeling of hundreds of processes or activities. Even with the right participants, the emphasis on detailed modeling across the whole scope of the

planning domain may bury the creativity and big-picture thinking needed to succeed. One manager at Cedar Industries complained that SDP participants were too caught up with documenting the existing business processes and "took too much for granted" to come up with innovative business solutions.

Objective #5. Promoting education or communication

Almost every SDP effort in Table 5 seems to have clear benefits to its team members in terms of understanding the importance of data and the degree to which it is shared across the organization. This engenders a new perspective on designing systems to meet business needs and may be one of the most predictable outcomes of the process. In at least one case (Ventura Finance), increased understanding of data issues throughout the division may have produced a major turning point for the way information systems development is viewed by the whole organization. However, there are several important concerns here.

Proposition #14: The new understanding seems difficult to communicate.

In reviewing and synthesizing the planning literature, Boynton and Zmud (1987) note the importance of an "organizational learning analysis" during the planning process to assess how new technologies will be accepted and institutionalized throughout the organization. Our research suggests that organizational learning is not always a by-product of SDP. In some cases, team members report that their new insight is quite compelling to themselves, but they have great difficulty convincing others, including top management and the participants' peers. At Consumer Publishing, team members felt the 75 users they interviewed never did understand what the project was all about. At Waverly Chemicals it reportedly took weeks for team members to come to an understanding of SDP and its purpose. It is almost as if each person must go through the SDP initiation themselves before they "see the light." If this is the case, SDP is a very expensive technique for organizational learning.

Proposition #15: The cost of an SDP can probably not be justified by education and communication alone.

If the SDP effort can be justified in terms of some combination of the other benefits, then the education/communication benefit may be a bonus. However, from these cases it seems clear that education alone is not sufficient justification given the high cost of the methodology. For example, the major benefits at Ventura Finance seem to have been a turnaround in divisional attitudes toward systems development and data sharing. It seems reasonable to ask, if education and communication were the primary objectives, if there were other less expensive approaches available.

Conclusions

Although some previous researchers have questioned the basic efficacy of the SDP method, there has usually been the implicit assumption that if problems in the implementation of the approach are identified and addressed, the expected benefits will follow. In a sense, practitioners have been encouraged to "try harder." This paper suggests that "trying harder" may not be the answer in many situations.

Given increasing business pressures to improve the shareability and accessibility of data across the organization, there is an important need to understand why strategic data planning efforts are often not successful and to begin the process of rethinking the SDP methodology with an eye toward modifying it, or replacing all or part of it. The 15 propositions presented in the previous section suggest some insights to help guide that rethinking. Two important conclusions follow from these insights.

First of all, SDP may not be appropriate in all situations. It seems most appropriate when the goal is integrated systems, either in the near term or the long term. Because achieving this objective can be extremely expensive, top management may balk at paying the bill unless extensive data sharing is essential to its view of the future organization. Even here, if the organization is too big or too decentralized, the planning process may become bogged down in detail or splintered by divergent interests. Thus, where data sharing is not absolutely critical, or the organization is very large or very decentralized, an SDP may not be appropriate.

Second, even under the most favorable conditions, the methodology may have a flaw that is

hinted at by these cases. The heart of the SDP methodology is the analysis of business functions and their data requirements to build a data architecture. This task seems to absorb 50 percent or more of the total time devoted to the SDP. The assumption is that given the right participants and cooperation from the rest of the organization, the resulting architecture will be correct enough to serve as a blueprint for more detailed data and systems design. Several findings from these nine cases seem to challenge that basic assumption. First, the participants themselves express uneasiness about the correctness of their architectures. Second, systems developers complain that the architectures are too high-level to be useful in designing systems, or they contain errors that are only apparent when a more detailed analysis is conducted. And third, other organizations using quicker, easier methods (such as "stealing" an architecture, or putting six IS professionals in a room for a week to create one), are able to develop similar architectures at a fraction of the cost.

If few SDP's succeed in producing robust architectures for their organizations, then perhaps practitioners, consultants and academics should focus a great deal more energy on what is required of an effective data architecture and how to produce one more efficiently. Certainly the most effective form of an architecture will depend on how it is to be used, and the specific intended use of the architecture appears unclear in most of the nine cases reported. Even if the specific use and desired form were known, it is probable that there is no single "correct" architecture for a given organization. Perhaps there are a number of reasonable ways to structure the basic processes and data requirements of a firm into an architecture, some of which capture the true underlying business better than others.

This suggests that a great deal more attention should be given to (a) understanding specifically how data architectures can be used in large organizations, and (b) developing generalized or industry-specific architectures that can be adopted and modified by those firms wishing to plan for integrated systems. These "stolen" architectures will certainly not be perfect for a given organization but, by all the evidence, neither is the more expensive product of an SDP. Removing the need to develop a data architecture from scratch would free up the planning team's time and energy to focus more rapidly and creatively

on the business' strategic directions and the way in which the data architecture should be tailored to facilitate those.

The evidence of the nine cases presented here strongly supports the need for a fundamental rethinking of IS planning methodologies that focus on data integration. This paper should be considered only the beginning of new research in this important area.

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Appendix A

The Process of Strategic Data Planning

Though there are differences between the various methodologies, there are a great many similarities. The participants in an SDP should always include business personnel (users) and may include IS personnel. Getting the right participants is critical to the quality of the final product. The planning team is charged with designing an "ideal" information environment that will support current and future business needs regardless of a particular organization structure. The process involves at least the following steps:

1. An enterprise model of the organization is developed, consisting of an identification of the business functions (usually 10 to 30) that the organization performs, further broken down into processes within functions (perhaps 100 to 300 processes all told). These processes may be further broken down into activities within each process. The processes or activities may be related to organizational groups responsible for them.
2. The data entities used by these various processes or activities (such as customer, purchase order, location, product) are identified. (There might be several hundred or more entities used by a medium to large business.) Each of these entities is associated with the processes or activities that use or create it.
3. An "affinity analysis" is performed to identify groups of entities that are closely associated. These become the candidate subject databases, which should be adjusted manually based on other considerations.
4. The subject databases and the processes that use or create that data are grouped so that major system areas can be identified.

Often taking place concurrently with the above, another effort documents how business processes and activities are currently supported by existing information systems.

Senior managers are interviewed to determine the executive point of view, including current and future business objectives. This usually occurs after the above steps have been completed.

These efforts come together to produce a set of plans or architectures that typically include a list of the organization's recommended subject databases and major application areas, a migration plan from current to desired systems, targeted applications, resource allocation recommendations for application development, and guidelines concerning standards (hardware, software, and data).

Appendix B

Brief Writeups for the Five Case Studies Involving SDP^a

Derrick Energy

Background. The largest subsidiary of a *Fortune* 50 Industrial Corporation, Derek Energy Products finds, acquires, and produces oil and gas, and markets them domestically and internationally. Prior to a major reorganization in 1982, all IS services (mostly batch systems) were provided by the parent company from its centralized IS organization, with significant dissatisfaction from the divisions.

Motivations/Goals for the SDP. Rapid changes in the regulatory environment and the petroleum market forced top management of the production division to recognize that the division's reactive approach to systems development was inadequate to meet business needs. In 1982, the production division's top management enthusiastically initiated a Business Systems Planning effort to improve the effectiveness

^aFrom the 31 data management efforts in 20 companies, as reported in Goodhue, et al., 1988.

of information systems to meet business needs. The goal was to produce a long-range IS plan and information architecture for the division.

Highlights of the Planning Process. IBM's Business Systems Planning methodology was used. Four key line/staff managers worked for six months with extensive support from the IS staff. A long-range IS plan was produced, as well as an information architecture identifying nine major information systems with 34 business processes and 50 data classes.

Results of the SDP. Shortly after the plan was complete, Derek Energy underwent a major reorganization, with the Production, Exploration, and Gas divisions consolidated into an integrated company, with its own IS department reporting to the VP of Marketing and Business Planning. The BSP was shelved as incomplete for guiding IS development in the reorganized Derek Energy Products. In 1984, DEP formulated a new long range IS strategy that identified a "target future state" for the company's information systems. Key user managers participated with IS in the development of an implementation plan based on the "target future state," critical business objectives, and the current slate of systems requests. As part of the planning effort, a second BSP effort was recommended by IS, but reservations from a number of VPs, fallout from the recent reorganization, and the need to complete the study rapidly convinced IS to assemble a small group of IS professionals (but no users) to extend the business process/data model from the earlier BSP to the new company. It was still unclear how to implement the resulting long-range plan, but finally the BSP information architecture was used in categorizing the 50 current project requests and made it apparent that a third of them depended on the same six subject databases. Those six databases were then implemented.

National Technologies

Background. NT is a family of companies producing relatively homogeneous products and services for geographically dispersed, domestic markets. NT has annual revenues of over \$5 billion, making it one of several dominant firms in its industry. Most of the NT companies' information systems needs are met by its Information Management and Services subsidiary.

Motivations/Goals for the SDP. In 1982, the central IMS planning staff began a comprehensive data planning effort to develop an inventory of business/data relationships as a critical first step in responding to the complexity and variability in NT's business environment. The goal was to link strategic IS planning with strategic business planning and to link a logical model of the business data with the development of physical databases and systems.

Highlights of the Planning Process. The planning effort took about one year and involved eight people from IS planning and the user community. Eleven hundred activities, 80 data entities, and 22 subject databases were identified.

Results of the SDP. Differences in the way six major groups within the IMS organization viewed the purpose of the SDP and its ultimate use caused significant friction between these groups. Although the strategic data model was completed and turned over to systems development teams, the model was not adhered to. The pressures of the operating environment took hold and deadlines became the significant driving force, not the global data model. Also, conflicts among the users about definitions and uses of data arose, despite the generally agreed upon data model. In addition, limitations in data-oriented design tools and relational database technology were noted.

Waverly Chemicals

Background. Waverly is one of the 10 largest firms in the chemicals industry, with sales of over \$5 billion. Because the various line divisions produce quite different products and use different processes, considerable autonomy has evolved between the divisions and corporate offices. Like many other staff functions, information systems and services are provided by both a central corporate group and by division groups.

Motivations/Goals for the SDP. General Polymers, Waverly Chemical's largest division, began a strategic data modeling effort for the entire division after the successful implementation of common manufacturing systems. Its goal was to move toward the long-term systems and data standardization to address the problem that "people didn't speak the same language," i.e., they utilized different definitions for words such as backorder, part number, working inventory, etc. The SDP was also to be used to help create a strategic IS plan that identified business areas that had little systems support.

Highlights of the Planning Process. It reportedly took five weeks to give line managers on the project team a clear understanding of what SDP was and why it was necessary, three weeks to teach them the logical data modeling tools, and three months to construct the data model. The effort identified 93 processes, an unidentified number of data entities, and 14,000 individual entity associations, which were aggregated into 14 subject databases.

Results of the SDP. Because of a downturn in the division's primary business, limited action on the plan has been taken in terms of the underlying transaction systems. The division, however, has shown its data model to other Waverly divisions, and at least one of them has decided the model is a 95 per cent fit to its business needs. This second division has resolved differences between the two divisions' data needs by making the model more general so it can encompass the needs of both. Both divisions have used the model as a bridge between line management's critical success factors and its data needs, and have speeded up the development of systems that draw data from existing transaction processing systems to create information databases targeted to specific management needs.

Consumer Publishers

Background. Consumer Publishers is a large publisher of books, records, and related consumer products. It is a very centralized organization, with a corporate IS department addressing all IS needs, including supporting end-user computing.

Motivations/Goals for the SDP. In the early 1980s competitive pressures motivated top management to look for cost savings, and it became clear that an integrated mailing system should replace an existing hodgepodge of systems. There were conflicting opinions between marketing, production, and operations about how to go about developing such a system and what it should entail. About this time, James Martin's organization, Data Design, Incorporated, convinced the head of IS to build a high-level data model and push it down into subject databases.

Highlights of the Planning Process. Over the course of nine months, six IS team members interviewed about 75 users. There were a number of problems including: Some team members had little experience with the business perspective; not all of them understood what their mission was; or they spent too much time arguing over the right level of detail. About 30 functions and 90 entities were identified; the 90 entities later collapsed into 26 subject databases. Forty-one systems projects were identified and prioritized, but the team's confidence in this list of projects was low. It was also hard to tell how big each of the projects were, because the analysis was at too high a level of detail.

Results of the SDP. The IS department felt that the value of the effort was greater understanding on the part of the IS participants—the plan itself did not tell them anything they didn't already know, and they doubted the users even remembered participating. The SDP report was literally "put on the shelf" after completion, and never implemented. However, shortly after the effort ended, a separate effort at defining the key underlying databases for the organization was begun by a small group of senior IS analysts, and parts of this effort have been implemented. It is possible there was some carry-over of knowledge and understanding from the first effort to the second, although one key participant in the second effort did not think so.

Foothill Computers

Background. Foothill Computers designs, manufactures, sells, and services computers and associated peripheral equipment, and has revenues of over \$1 billion. The organization is decentralized, with each

line area having its own MIS organization that reports in a dotted-line fashion to the head of corporate MIS. Managing data has long been recognized as an important issue, and the company has tried a number of approaches in an evolutionary process—the difficulties encountered with each approach provided lessons and guidance for new approaches.

Motivations/Goals for the SDP. In the mid 1980s Foothill embarked on a major strategic data planning effort for a new order administration system to be used world-wide. The goal was to implement integrated systems to span the complete order administration domain for all products.

Highlights of the Planning Process. This very visible problem area was viewed as a high risk, high payoff test of a new methodology focused on data, process, and business events. Though this methodology was viewed as a viable alternative at the time, there were some problems in the planning process because some team members had too little training (as little as one day), and some may have emphasized form and format over content. As deadlines approached, some groups reverted at least partly to a more traditional functional specification approach. Even so, there was at least nominal agreement world-wide on the basic data model.

Results of the SDP. When it came time to implement the data model in actual systems, there were political problems because the various international groups could not agree on important design considerations, so they split off to develop their own systems. Stateside users were too busy with a reorganization to devote much time to the efforts. When top management re-evaluated what it would take to complete the system (\$20 million), they decided to discontinue it.

Appendix C

Sample Interview Questions

1. Interviews of Individuals Responsible for Methodology

Part A. Questions related to the philosophy and mission of the planning group

What is the mission of your group? How long has your group been in existence? Why was it created?

What is the history behind data management efforts? What is motivating data management? What data management approaches is the organization taking?

What is your definition, or vision, of an architecture?

Part B. Questions related to the planning methodology and planning efforts

What are the goals and expected outcomes of strategic data planning efforts?

Does the methodology link strategic data planning efforts with business planning? How?

(This person was also asked to describe the specific SDP effort being studied.)

2. Interviews of Planning Participants

Part A. Background questions

What was the motivation for the study? Was a business case prepared? By whom? To whom was it presented? What was the reception?

Part B. Questions related to the planning process

Was the strategic data planning exercise integrated with the overall business planning process? How?

How much of your time did you devote to the planning effort? On average, how much time did each team member devote?

How long did the planning effort last? What were the steps in the planning process? How long did each step take? Who was involved in each step?

Part C. Questions related to the success and failure of the planning process

What did you expect to get out of the planning process? Were those goals achieved?

What were the specific end-products of the process? Can you show us?

How would you characterize the planning effort in terms of its success? Why?

What were the benefits of the planning process? The problems?

What factors contributed to the success or failure of the effort?

Part D. Questions related to the usefulness of the plan

How will you maintain the output of this planning effort?

Do you expect to do another planning effort? Why or why not?

What has happened since the planning effort? Has the plan been implemented? Have specific projects been designed and implemented? Why or why not?

How have others (e.g, systems analysts, IS and business managers) reacted to the plan?

3. Interviews of Individuals Impacted by Plans

Are you aware of the plan? Is it being followed?

How has the plan impacted your work? Has it produced a better list of systems, better requirements, better use of resources?