Payoff

Technology management encompasses the range of issues encountered when introducing and deploying information technology in support of business operations. This article discusses how IS and technology planners determine what technologies will be appropriate for the organization and achieve alignment between technology and business strategies. Business process redesign is described as an approach to effectively combine business strategy, process improvement justification, and new information technology.

Introduction

The drive to seek improvement has resulted in a burgeoning interest in technology management ranging from acquisition through exploitation of new technologies. Although many technologies are of primary interest to one or two industries, all industries have a common interest in information technology.

Most major corporations would not be able to operate their businesses without computer systems. Executives have awakened to the fact that technology management is as important for their information systems as it is for their manufacturing facilities and their products. As a result, IS departments are under pressure to meet the same goals of efficiency, cost reduction, and responsiveness as other departments within their companies. This article details the objectives of technology management and the link between the introduction of new information technology and Business Process Redesign.

Technology Management

Two major issues, inexorably linked together, trouble IS directors of major corporations. These issues are:

• Supporting the redesign of company business processes.

• Replacing legacy systems that are impeding the IS function's ability to respond flexibly to business needs.

The link between these two issues is the ability of the IS function to plan for, acquire, and deploy new information technology for the development and operation of new applications.

The internal needs of IS—better price/performance ratios, faster software development paradigms, specialized application capabilities, smaller increments of capacity increases, and improved architectural flexibility—generally require a substantial short-term increase in new technology costs before the long-term benefits can be realized. Although business needs have spurred the adoption of new information technology, in many cases, IS departments are poorly equipped to deal with the entire scope of managing the introduction of new technology to the organization. Technology management is not only a problem for IS. In fast-paced industries such as biotechnology or electronics, technology management is critical to their continued survival.
The scope of technology management includes a broad range of activities such as:

- Strategic technology positioning.
- Tracking technology trends.
- Aligning technology needs with business needs.
- Identifying appropriate new technology.
- Identifying the technology rendezvous (i.e., the relative importance of technologies to the business compared with the time at which the technology should be adopted by the company).
- Justifying technology acquisition.
- Acquiring new technology.
- Introducing new technology.
- Adapting technology to the business needs.
- Deploying technology.

This article offers a strategic perspective on some of these issues.

**Strategic Technology Positioning**

Although many aspects of technology management could be assumed under this activity, this article takes a narrower view. Strategic technology positioning consists of adopting policies and procedures that set forth the management position regarding technology. An organization may determine that its competitive position is best served by being an adopter, an adapter, or an inventor of technology. Adopters frequently use off-the-shelf products and thus trail others in technology acquisition. Adapters make technology an essential element of their value-based planning and use new technology in innovative ways. Inventors seek opportunities through creating new or innovative uses of technology to stay far ahead of competition.

Furthermore, producers must accommodate the feedback of technology opportunities to the business plans. Strategic business plans developed without regard to the competitive threats and opportunities supported by technology advances can be blindsided by more aggressive users of technology. The clearly stated positions embodied in policies and procedures reinforce a strategic approach to technology planning and acquisition. They also ensure that valuable employee time is spent in accordance with corporate policy.

**Tracking Technology Trends**

Large IS groups frequently have specific positions created to track technology. Technology tracking activities are often part of a technology planning or systems architecture group within the IS division. Although some managers feel that technology tracking is a part of every system analyst's job, the more successful results are obtained when the effort is not
so diffused. Because successful technology planning must be continuous, specific assignment of responsibility is necessary. In smaller companies that cannot dedicate full-time personnel to this task, the responsibility should be made explicit for one or two individuals as a part-time function with defined results expected.

Technology tracking can only work properly in the framework of strategic technology positioning. It is futile to track emerging technologies if the company’s position is that of an adopter. However, for technology adapters and inventors, a vision and understanding of the future and of technology life cycles is imperative. This understanding of the technology life cycle serves as a means to determine areas where skills need to be developed, to identify new projects, to improve productivity and quality, and to anticipate potential competitive advantages and disadvantages. A technology's life cycle consists of six stages:

- **Breakthrough and basic research.** The technology is invented and advanced to a stage at which product development is feasible.
- **Research and development.** Initial products are developed.
- **Emergence.** Products are introduced and the market is educated to accept the products.
- **Growth.** New products using the technology continue to be offered at a rapid pace.
- **Maturity.** The market for the technology stabilizes and products become commonly applied.
- **Decline.** The technology is superseded by newer technologies that have functional, cost, or performance advantages.

Usually, businesses must consider technology applications rather than simply individual technologies. Technology applications are generally constructed by blending individual technologies; personal computing, for example, was made possible by technology trends in miniaturization, local area networking, and Graphical User Interface, among other technologies. By monitoring the stages of information technologies, which develop at different paces, a company can observe the applications to which technologies are applied.

### Aligning Technology Strategy with Business Needs

Tracking technology without regard to the needs of the business can waste a lot of time and money. It is absolutely critical that those tracking the technology be aware of its potential uses in the processes and products or services of the company. This knowledge enables technology planners to:

- Appraise those technologies that may be used immediately for competitive advantage.
- Appraise changes or new developments that may be used for competitive advantage over the next three to five years.
- Identify potential applications of current and future technology and how such applications may affect the competition.
Identify potential changes in current applications driven by market demands or technology developments.

Aligning technology strategy with business needs is one of the most frequently identified problems facing corporate IS executives. This alignment requires knowledge of the business operations of each strategic business unit in the corporation, their competitive business strategies, and the best available information on the technology and business strategies of their competitors. In addition, it requires the active participation of both information technologists and users to develop an understanding of the potentials for use of information technology and a consistent vision of the future.

Research in technology management and product development has shown the success of triad management. Triad management techniques create teams of marketing, technology suppliers (e.g., engineering or R), and manufacturing representatives to rapidly introduce new technologies or bring new products to market. Similarly, most successful IS implementations are those that were required and driven by the users. To achieve alignment, IS must form alliances and occasional task forces or teams with user organizations. Technology planning is no exception if the alignment of technology and business strategy is the goal.

Alignment of technology strategy with business strategy requires two modes of operations:

- The technology strategy must be able to respond quickly to changing business needs.
- The technology potential and vision must be able to influence the development of business strategy.

**Technology Planning Specialists**

Even though the profusion of personal computers has forced employees and managers to become more computer-literate, most noncomputing professionals do not have insights into the full potential of computing and communications technology. Technology planning must continue to be the responsibility of technology planners.

Technology planners should make a point of meeting with user managers, not only to educate them informally, but to learn about their business operations and needs. Most people are flattered to be asked about their job, and most line managers will readily respond to requests from IS personnel to learn more about their business operations.

Technology planners also need to discover how competing companies are using information technology. This does not imply industrial espionage, but simply tracking the trade press, attending industry or information technology conferences, and talking with prospective vendors and suppliers. Innovative applications can arise outside the company's industry and be applicable to company needs, so this intelligence effort should not be confined to the company's industry.

Increasingly, close cooperation with both suppliers and customers is needed to be competitive and to respond to market conditions. It is now necessary to view the organization and its business processes as a part of an extended enterprise composed of the organization, its allies, suppliers, and major customers. Technology planners must either create relationships within the businesses that will provide the perspective of the extended enterprise or they must initiate relationships with key suppliers and customers to understand their uses of information technology and how the company's processes need to interface to those of its business partners.
Building the Business Case

As technology planners acquire a knowledge of the industry and the business, they must document this knowledge so it may be used to build a business case for new applications. They also need to find a way to translate the needs of strategic business units into a projection of when and how new or emerging technologies will influence the company's industry.

First, with a knowledge of the industry's business processes, technology planners can construct a value chain. For example, in a manufacturing company, the value chain may contain the major elements of R, engineering, logistics, operations and manufacturing, marketing, distribution, sales, and service. New technology can affect any aspect of this chain through such areas as product design tools, materials or components procurement, inventory management, manufacturing methods and controls, maintenance of plant and equipment, packaging processes, and sales and service tracking. The potential applications that can provide leverage and maximize the contribution to the corporation from technology investment can be recognized. In addition, the technologies capable of supporting those applications can be identified.

Working with user managers, technology planners can gain an understanding of both the leverage points and the perceived priorities of managers. These factors determine the relative importance of various technologies to the organization compared to the time at which the technology should be adopted by the company. Exhibit 1 illustrates how the technology rendezvous may be presented to management.

Charting the Relative Importance of Information Technologies
(Technology Rendezvous)

From the example of Exhibit 1, it is possible to identify clusters of technology that must be introduced over time to keep a company competitive. In this example, the cluster of technologies in the upper-left corner of the chart indicates those technologies that will be most important in the shortest period of time. Technologies of immediate and short-term importance must be considered in the early stages of implementing a technology plan. The plan must consider other technologies in an evolutionary fashion.

The technology rendezvous is important for meeting strategic alignment objectives. When constructed on the basis of knowledge of the industry and the competition, it provides a senior executive view of the needs for introducing new technology or extending the use of currently available technology to remain competitive, thus influencing corporate business strategy. Simultaneously, it provides IS with a view of when and how it should anticipate training, experimentation, and application development using these technologies. This knowledge directly influences long-range application planning, IS budgeting, and hardware and software selection.

Information Technology Deployment

Professionals involved in technology management have discovered that technology per se is rarely deployable. Instead, technology is deployed through application.

For example, a new technology for the manufacture of integrated circuit is deployed through the change of processes and equipment on the production line; a new materials technology for manufacturing automobile fenders will be deployed through changes in the
molding equipment and the manufacturing and assembly processes. Similarly, new information technology is deployed through its application for the benefit of the company and its processes and users.

Information technology deployment through applications means changes and requisite training for the application designers and developers as well as for the users. The processes that will change may include requirements definition, systems design specification, programming, user documentation development, application testing, system installation, system support, and end-user business processes. These changes may result in an organizational change to the systems development and maintenance function to permit more rapid applications development and better field support to users. Substantive changes that allow companies to take full advantage of enabling information systems technology almost invariably require changes in the business processes and in the organizations that perform these processes.

Up to this point, this article has dealt primarily with technology planning, including identification of business needs and identification of appropriate new technologies to support those needs. The actual acquisition and introduction of new technology requires justification in terms that will meet the approval of senior management responsible for the company's destiny. Even if the planning stages have been carried out with appropriate involvement and approval by senior management, the introduction of specific elements of the plan requires detailed planning and justification based on the benefits of applications to the business.

Two types of technology introduction predominate: those that do not have an impact visible to the users and those that have a direct effect on the user. In the first case, for example, an IS department may introduce a subsystem for massively parallel processing that adds capacity to process additional transactions of the same nature and, in the same apparent manner, as current transactions. Such a technology introduction may be invisible to the users of the systems (other than the impact from system testing before implementation). However, it would be highly visible to the IS department as new design and programming techniques are introduced. Many other introductions of new technology inevitably change the way employees who use the applications perform their tasks.

Reengineering

The goal of many organizations is to replace old systems with new ones that are easier to maintain and modify, support the types of user interfaces to which users of personal computers have become accustomed, and support new modes of business operation. For many applications, downsizing of equipment and the introduction of client-server architectures will provide significantly lower operating costs.

One reason that apparently successful systems development projects have not achieved expected benefits is that the applications were designed to support existing business processes. When existing business processes form the foundation for the requirements definition, even anticipated gains in efficiency may be unrealized. The result: companies have begun using a collection of methods and tools under the general name of Business Process Redesign or reengineering.

Many consulting firms have adopted variations of the BPR methods. Stanford Research Institute International defines BPR as a methodology for transforming the business process of an enterprise to achieve breakthroughs in the quality, responsiveness, flexibility, and cost of those processes in order to compete more effectively and efficiently in the enterprise's chosen market. BPR uses a combination of industrial engineering,
operations research, management theory, performance measurement, quality management, and systems analysis techniques and tools simultaneously to redesign business processes and to harness the power of information technology to support these restructured business processes more effectively.

BPR projects are designed to take a fresh look at a major business process from a customer perspective. The customer of a process may be the external customer of its products or services or may be the internal recipient of the process output.

Redesigning business processes using new technology benefits the company by improving efficiency and making business processes more responsive to customer needs. In the end, it represents a clear manner in which technology influences the strategy of the company.

SRI's seven-step BPR methodology and some of the associated elements, tools, and techniques used are outlined in Exhibit 2. By using this or similar BPR or reengineering approaches, organizations can overcome resistance to change and the problems of maintaining the effectiveness of employees during the period of transition to the new systems and business processes that affect the way employees perform their jobs.

**Seven-Step BPR Methodology**
Guidelines for Successful Technology Deployment

Project Framework
Few companies succeed with projects that massively change the entire company's operating structure. New technology introduced within such a project framework runs a high risk of adding to the company's problems rather than solving them. Generally, projects that address a single process (e.g., materials procurement, loan approval processing, or claims processing) have a greater likelihood of success. Success in the initial project that introduces new technology is crucial to expanding the use of the technology in the organization. In fact, it may be critical to the entire process of acceptance of new technology by management and employees.

Keep Employees Well-Informed
All affected or potentially affected company personnel should be provided with regular information about the BPR project's purpose, status, effect on existing processes and employees, training schedules, and interface needs. This information should be delivered within the context of the expected benefits to the company's competitive position so that everyone involved retains a focus on the value of the change.

Acknowledge Downsizing Effects
If staff reductions are anticipated, employees should receive a statement from senior management at the beginning of the project about how such reductions will be managed. For example, a statement that all staff reduction will be managed through normal attrition can make a major difference in employee cooperation. Management positions on how employees will be retrained, what options exist for transfer or early retirement, or what types of outplacement support will be provided should be publicized. Some companies have offered bonuses to employees facing displacement so that they will remain at their positions until new systems or processes are completely installed.

Continuity
The implementation time for redesigning a major business process and introducing new technology that enables the new process may be two or more years. It is vital to the success of the project that the senior management sponsors of the project be committed to this time frame and that they be kept informed of progress throughout the implementation.

Continuity and consistency of implementation must be ensured. Midstream changes in the project plan should be discouraged, unless they are critical to the end result of the project (for example, a midcourse decision to outsource the function supporting the process) or caused by changes in the external environment of the business process (as in a change in the organization's investment capability). Expect minor changes and fine-tuning during the period right after implementation.

Coordinated Assistance
Advice or assistance should be sought and encouraged from both management and the employees involved in the project during implementation. For example, it may be appropriate to seek the assistance of the human resources or personnel functions to deal with changes that affect employees. Furthermore, coordination with the managers of functions that use the output of the redesigned process must be maintained to ensure that
new interfaces operate smoothly. If the process involves external suppliers or distributors, it may be necessary to set up a help desk or hotline during the implementation phase or train field representatives to assist such external participants.

**Evaluate and Monitor the New Process**

Where possible, it is essential to set up and evaluate a pilot operation of the redesigned business process. Debugging is always easier when only a limited part of the company's activities have been committed.

The results of the process change should be monitored in terms of the measures and goals established during the analysis phase, and these results should be periodically reported for at least the first year or more of the implementation. The measurement devices should be built into the new process to provide continuous measurement and to form a basis for further evolution in the future.

**Conclusion**

Acquiring appropriate technology that can advance an organization's competitive position requires a dedicated and continuing effort. Acquisition of appropriate technology first requires that the technology planners understand the needs of the business and the strategic technology position that senior management has adopted.

Second, technology planners must maintain an awareness of technology trends to ensure the organization's ability to support its business needs and technology position. Technology planners must position IS not only to support the organization's business directions but to influence company or business unit strategy. Next, IS and technology planners must justify the adoption of new technology in terms of the new or improved business processes that the new systems will support. The key to successful introduction and deployment of new information technology is Business Process Redesign that combines the business strategy, the process improvement justification, and the technology into a coherent approach that can be readily conveyed to senior management.

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Note: The technologies being tracked and the technology rendezvous will be different for each industry and, to some extent, different for each company, based on the technology position maintained by the company and the relative level of technology already in place.
1. **Step**
   - **Taking the Customers' View.**
     Identifying factors that lead to customer satisfaction from the customer perspective.

2. **Step**
   - **Taking Management's View.**
     Identifying management's perspective of factors that lead to customer satisfaction and the differences between the two perspectives.

3. **Current Process**
   - **Definition and Measurement.**
     Documenting the current business process; measuring output of the process and subprocesses to develop a foundation for the redesign.

4. **Working Group Education.**
   - Educating client’s BPR participants about the potentials of process restructuring and IT as applicable to the problem domain.

5. **Identifying Change Opportunities.**
   - Brainstorming with BPR team members to create a new business process.

6. **Analysis of Recommended Action.**
   - Conducting detailed planning of the new process; identifying IT implications, new technology trends, new system architectures; developing cost/benefit estimates; and preparing a proposal to management for the business process change.

7. **Approval, Commitment, and Implementation.**
   - Obtaining management approval and detailed project planning.