S*P*A*R*K: A knowledge-based system for identifying competitive uses of information technology

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The use of information and information technology (IIT) as a strategic tool to gain competitive advantage has become increasingly significant in recent years. Numerous examples of how firms are using IIT to improve their competitive positions are highlighted in both popular and academic literature. Although the potential competitive benefits of IIT are generally recognized by business and I/S executives, there is a great gap between recognizing such value and applying the technology effectively. To help bridge this gap, a group at the IBM Los Angeles Scientific Center has developed a knowledge-based system facilitator, called S*P*A*R*K. The system is designed to help business and I/S managers identify competitive applications of IIT to help them be creative in generating a range of IIT alternatives. This paper provides an overview of S*P*A*R*K, including the conceptual frameworks used for knowledge sources, the design philosophy, functions, and implementation approaches. Examples from a database of competitive applications of IIT are also presented to provide a flavor of the S*P*A*R*K facilitative processes.

Traditional information management issues have dealt with the use of information technology for efficiently and effectively supporting the internal operations of a business. Methods, techniques, and computer-based tools have continually been developed to help model the business, identify its information requirements, plan for information systems to support the requirements, and design and develop those systems.

Although that focus continues to be important, another related area that has become increasingly significant in recent years is the use of information and information technology (IIT) as a strategic tool to gain competitive advantage. Firms such as American Airlines, United Airlines, Merrill Lynch, American Hospital Supply, and McKesson are often cited as examples of companies that use information systems to improve their competitive positions. These successes, coupled with fears of being placed at a competitive disadvantage from systems developed by others, have begun to motivate general managers to consider carefully the potential impact that IIT might have on their firms.[1]

Strategic or competitive use of IIT refers to the use of information and information technology both to

support and shape a firm's business strategies. IIT can be used to differentiate existing products and services, create new products, enhance services and lower costs to customers, and help focus on particular market segments. IIT can also be used to introduce switching costs to customers, to gain leverage with suppliers, to introduce or break barriers to entry, or to alter completely the basis of competition within an industry. A portfolio of examples of the use of IIT is given at the end of this paper.

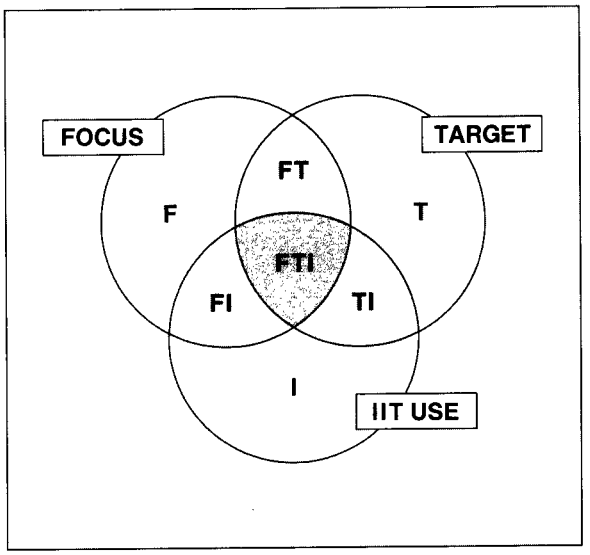
Although the potential competitive benefits of IIT are generally recognized by business and I/S executives, there is a great gap between the recognition of such value and the ability of many firms to apply the technology effectively. To help bridge the gap, some executives may look to the various conceptual frameworks proposed by academics and practitioners. These frameworks describe issues involved in using IIT competitively, in classifying successful strategic applications, and in evaluating the potential of proposed applications.[2] By themselves, these frameworks are not usually helpful in identifying new, competitive applications of IIT. If, however, they are used in conjunction with a facilitative process, the interaction can generate new ideas about competitive uses of IIT.

With this as our premise, we developed in 1986 a prototype of an expert system-based facilitator, called S*P*A*R*K. Using a conceptual framework known as customer resource life cycle,[2] S*P*A*R*K was designed to help business and I/S managers identify competitive applications of IIT. The goal was not to evaluate the new ideas but to generate ideas in the first place.

As its primary facilitative vehicle, S*P*A*R*K presented real examples of strategic and competitive IIT applications drawn from various industries. The facilitative technique was to help users draw analogies between these examples and their own competitive situations—that is, to help find application ideas that could be adapted to their environments.

S*P*A*R*K was demonstrated to a number of corporate and academic audiences who showed considerable enthusiasm for the S*P*A*R*K approach and encouraged further work. Consequently, S*P*A*R*K is being redesigned and rebuilt, with an elaborated set of conceptual frameworks, significantly more examples (approximately 300), and enhanced facilitative processes. Throughout the redesign process the goal remains the same—to help users generate a range of ideas for the competitive or strategic uses of information and information technology.

Figure 1 Three major domains of conceptual frameworks



In this paper we provide an overview of S*P*A*R*K. We discuss first the conceptual frameworks used in S*P*A*R*K. Next, we present the design philosophy, functions, and our implementation approach. Finally, we give examples from the database of IIT competitive applications.

Strategic perspectives

With the emergence of strategic information systems as an important new capability, considerable attention is being paid to the development of conceptual frameworks for analyzing, describing, and understanding these systems. The frameworks provide different approaches to thinking about competitive positioning, strategies, targets, and the current and potential uses of IIT in business practices.

S*P*A*R*K incorporates a number of these frameworks. Having multiple ways to consider issues gives more opportunities to identify possibilities for one's own situation.

To help put the frameworks into perspective, we have organized them with respect to three major domains: (1) business strategy or FOCUS (F); (2) business TARGET (T); and (3) use of IIT (I). These domains are visualized by the Venn diagram in Figure 1. FT,

FI, TI, and FTI indicate the combinations of domains. To illustrate the underlying knowledge base of S*P*A*R*K, we discuss briefly each domain and show how some of the conceptual frameworks map to it. We note that many conceptual frameworks do not neatly fit into a single domain but contain knowledge relevant to two domains, FT, FI, or TI. However, we choose often to categorize a framework in terms of only one domain in order to concentrate on the primary thrust of that framework. This enables us to make more effective use of the framework's knowledge in the overall S*P*A*R*K context.

F: Focus. Conceptual frameworks that emphasize focus deal primarily with the analysis and formulation of business strategies or strategic thrusts that are the focus of a firm. Examples are Porter's competitive strategy[3] and Fredericks and Venkatraman's[4] five dimensions of strategy. Porter defines three generic strategies that a firm can pursue in order to gain and sustain competitive advantage: (1) cost leadership; (2) differentiation of product or service; and (3) focus, which is to seek out a particular market niche. Fredericks and Venkatraman propose a framework with five strategic dimensions—financials, products, customers, competitors, and time periods—each dealing with five strategic questions:

- How to add value?
- What to offer?
- Where to focus?
- With whom to compete?
- When to act?

As originally formulated, none of these frameworks specifically addressed IIT, but they are now seen as helpful in providing an orientation for considering how IIT might support or impact a firm's competitive strategy.

T: Target. Target refers to the object of a business strategy or business focus. A company aims its actions at particular targets such as customers or suppliers. Conceptual frameworks in the target domain concentrate on identifying and suggesting ways to deal with business targets so as to influence the firm's competitive position.

Porter,[5] for example, analyzes the following five major targets or competitive forces that influence firms in every industry: buyers (customers), suppliers, rivals, substitute products, and new entrants. He suggests strategies and conditions for attacking and defending against them in order to gain and sustain competitiveness.

The customer is the target analyzed by the customer resource life cycle framework.[2] This framework helps us examine categories of activities that customers perform with respect to a firm's product—such activities as determining the required quantity of a product, assessing a product's attributes, ordering and acquiring the product, maintaining it, and disposing of it. The framework offers suggestions for ways in which firms can differentiate themselves by helping their customers perform these activities via IIT support.

Focus is what a firm wants to do or does strategically, and target is usually the object of that action.

FT: Focus and target intersection. The focus and the target domains are closely related. Focus is what a firm wants to do or does strategically, and target is usually the object of that action. We differentiate these perspectives in order to allow different approaches to identifying strategic uses of IIT. One approach is to start with the analysis of competitive situations in the marketplace (target)—supplier relationships, distribution channel efficiency, market segmentation effectiveness, customer preferences, and so on—and search for ways to use IIT to gain competitive advantage. Another approach is to start with understanding the firm's strategies and their relationships, and search for ways to support them using IIT.

Wiseman's strategic option generator,[6] for example, deals with the focus and target perspectives jointly (FT in Figure 1). He identifies the following:

- Five strategic thrusts—differentiation, cost, innovation, growth, and alliance
- Four competitive arena targets—supplier, channel, customer, and rival
- Five system or user targets—the firm itself, supplier, channel, customer, and rival

Wiseman's strategic option generator prompts a series of questions related to these thrusts and targets and encourages its users to search systematically for IIT opportunities and threats.

I: IIT use. This category deals with opportunities offered by IIT. The approach here is to start with analyses of currently existing, in-house IIT capabilities and other available information technology, then to search for ways to shape or reshape business strategies (focus) to alter competitive forces (target), using these IIT capabilities. Examples of frameworks in this category include the McFarlan-McKenney grid[7] and Parsons's three-level framework.[8]

The McFarlan-McKenney grid helps with assessing the impact of a firm's information systems (I/S) on its business. The framework classifies firms based on the criticality of their existing I/S portfolios and on the potential criticality of their I/S development portfolios.

Building on Porter's work, Parsons examines the strategic implications of information technology at three levels—the industry level, the firm level, and the strategy level. At the industry level, Parsons examines how IT may impact the fundamental nature of the industry in which the firm competes. At the firm level, he discusses IT impacts on the competitive forces facing the firm, and at the strategy level, he discusses the implications of IT on the three generic strategies outlined by Porter.

FI: Focus and the IIT use intersection. The intersection of focus and IIT use is demonstrated with a perspective called Strategic Application Search.[9] A matrix of uses of IIT and marketing strategies facilitates the generation of ideas for IIT use. Uses of IIT are threefold: (1) automating information activities; (2) automating information linkages; and (3) using information to enhance tradeoffs.

Marketing strategies include:

- Gain a cost advantage
- Create/enhance products
- Enhance customer service
- Strengthen customer ties
- Increase bargaining power
- Block new competitors

TI: Target and the IIT use intersection. An example of the TI intersection is Feeny and Brownlee's opportunity search framework (OSF).[10] Designed as a front end to the customer resource life cycle framework (CRLC), OSF provides guidance on the circumstances in which a firm is likely to derive competitive advantage from offering any of thirteen CRLC-related services to customers. OSF helps position a firm in the following six dimensions of industry structure and suggests IIT opportunities:

- Perceived product differentiation
- Sector channel structure
- Relationship between need and product
- Frequency of purchase decision
- Frequency of delivery within contract
- Buyer access to IT resources

Although the value of using information technology for competitive advantage is recognized, how to begin is not always clear.

We have presented some of the conceptual frameworks used in S*P*A*R*K in terms of three major strategic perspectives—focus, target, and IIT use. The frameworks differ considerably in their scope and depth, from lists of issues to think about to more detailed guidelines on how to proceed. In view of such differences, we have incorporated various conceptual frameworks to take advantage of their respective strengths. The S*P*A*R*K knowledge base, then, falls in the central intersection FTI, addressing all three domains of the strategic and competitive use of IIT.

Design philosophy

Although the value of using information technology for competitive advantage is recognized, how to begin is not always clear to someone new to the field. Many times people have difficulty even identifying business problems or opportunities, which places the application of information technology to such situ-

ations far from their experience. To help people think of ideas for the competitive use of information technology, S*P*A*R*K provides two major aids: education and facilitation. An education component shows the utility of strategic information systems and provides a context to guide the search for applications. A facilitation component provides both suggestions of paths of thought to pursue and some help in following a particular chosen path.

Providing such education and facilitation has been problematic for organizations. For one thing, they are expensive when they involve large numbers of individuals. As a consequence, the tendency in many firms is to identify a single group and to charge them with the responsibility for generating ideas for competitive uses of information technology. Although this strategy is sometimes effective, it limits the number and scope of people who participate in the search and reduces the potential range of ideas generated. Organizations may also rely on professional outside facilitators to serve as catalysts for generating ideas. However, this has the limitation that strategic information systems must be treated with the same level of confidentiality reserved for new product introductions. They may in fact lead to new products. Therefore, the limitations of an external process facilitator should be clearly set forth to all parties at the outset. Given these problems, plus the limited number and high fees of outside experts and the frequent lack of in-house expertise in developing competitive information systems, we set out to develop an expert educator and facilitator, embodied in the knowledge-based system, S*P*A*R*K. Although it cannot lead a group discussion as a human facilitator can, S*P*A*R*K has several advantages. It is relatively inexpensive, it is secure, and it has a potentially large memory capacity for competitive applications of information technology.

Attributes of the situation faced by the user are matched with examples in our database.

To help educate and facilitate idea generation, we build into S*P*A*R*K knowledge about business management and the use of information technology. We do this by providing many conceptual frameworks for analyzing business situations and IIT uses, and by constructing a large base of real-life examples that show how organizations have used IIT for strategic advantage. Conceptual frameworks were discussed in the previous section. To handle the disparate knowledge of these frameworks, we treat each one as a separate approach within S*P*A*R*K. This allows us to use the strengths of different viewpoints and methods, while giving us the flexibility to integrate new frameworks as they emerge. The examples of real-life competitive uses of IIT are a stimulus for brainstorming. Attributes of the situation faced by the user are matched with examples in our database. The user can see how other organizations have employed IIT in similar circumstances. By analogy, users may generate ideas for their own competitive information systems.

This reasoning-by-analogy approach is based upon the premise that analogical association will trigger both learning and new ideas. We tried a similar analogical approach in the original S*P*A*R*K with positive results.[1] We note, too, that Sullivan and Yates[11] have also been successful with their reasoning-by-analogy method. Consequently, this version of S*P*A*R*K also provides a context for users to make associations between their situations and those of other firms and to see how those firms used IIT to their competitive advantage. These analogies may stimulate the user to come up with new ideas about IIT use.

Functional overview

S*P*A*R*K provides three main functions: (1) aid in choosing which business issues to focus on; (2) presentation of examples showing how organizations have used information and information technology to deal with those issues; and (3) help in exploring possibilities prompted by the examples.

To perform these functions, S*P*A*R*K gives the user a choice among the following three ways to begin:

- Learning different ways to analyze business issues and the uses of information and information technology
- Choosing an issue to focus on and then viewing examples related to that issue

- Working with a consultant to establish the business issues that require attention and to gain help in producing ideas for tackling the issues

The three ways to proceed are embodied in separate modules that we call, respectively, teacher, browser, and facilitator, as shown in Table 1.

Teacher module. Managers often view information systems as something apart from the real business of a firm. Helping managers understand ways in which information systems can serve and enhance business needs and goals is one key objective of the teacher module.

Another major objective is to present multiple ways to analyze business situations. Consider the following. The teacher first describes the three main components—focus, target, and IIT use—for this business analysis as illustrated in Figure 1. Understanding these three components helps in organizing a number of specific conceptual approaches. The user can choose among approaches such as Porter's value chain[5] or Wiseman's strategic option generator.[6] For each approach, a detailed explanation is available that emphasizes the internal logic of the approach and prompts the user to think how IIT might be useful if this approach is employed to analyze a company's situation.

Users who study the teacher module well often learn ways to assess their current business and IIT situations and thus discover both problem areas and opportunities.

Browser module. This module gives users a quick and easy way to access the database of IIT examples and provides structured menus of business and IIT attributes. The primary menu has the following four items: (1) line of business; (2) business focus; (3) target; and (4) IIT use. Submenus then specify additional options that represent the attributes used to classify examples for the browser. Users choose options (attributes), and the browser presents examples that demonstrate how various organizations have used information systems relevant to those attributes. Once examples are presented, users can record ideas on an electronic notepad, but they receive no further guidance as to how to reason or think about the examples. Thus the browser is a broad-brush means to decide on a focus area and to view appropriate examples.

Facilitator module. This is the most complex of the S*P*A*R*K modules because it incorporates knowledge about the various conceptual approaches, the IIT examples, and brainstorming or idea-generation techniques.

Table 1 S*P*A*R*K functions

Funtions / Modules	What to Focus on	Examples	Help with Examples
Teacher	✓		
Browser	✓	✓	
Facilitator	✓	✓	✓

Once a business area (e.g., a specific product) has been identified, the user may work with the facilitator to assess the competitive position of the firm in that business area. How the assessment is done depends both on the facilitator and the user. From all possible assessment methods known to the facilitator, it selects either the entire set or some subset to present to the user based on its accumulated knowledge of the chosen business area, market, and general business information. The user then chooses the particular approach from the set presented. If the user has no preference, the facilitator suggests a way to proceed.

The initial competitive assessment is not intended to be a full-blown look at things from every angle. Rather, the objective is to orient the user quickly to a rough sense of the firm's position in the marketplace and to help begin the thought process along competitive lines.

Alternatively, the user may work with the facilitator to examine possible strategies and targets for the defined business area. The user proceeds through a question-and-answer section for one or more selected frameworks. The S*P*A*R*K facilitator then analyzes the information and produces suggestions of targets and/or strategies for the user. For example, to decrease switching costs may be a strategy of interest with the supplier as the target, whereas to improve quality of product may be a strategy with the customer as the target.

As with the competitive assessment, multiple approaches are available for focusing on strategies and targets. As before, the facilitator makes the initial subset selection, after which the user chooses from the options presented.

As users go through the process of defining for themselves and for S*P*A*R*K where they want to concentrate their efforts, S*P*A*R*K continuously monitors the information obtained and compares it with the information it has in its database of IIT examples. Examples from the database are then selected based on S*P*A*R*K's current state of knowledge about the user's situation. This continuously updated set of examples is available to the user throughout the session. The user can choose to view any example from the currently available set as well as from the set of previously-viewed examples.

This continuously updated set of examples is available to the user throughout the session.

Once the examples are presented, S*P*A*R*K offers assistance in analyzing them and and in applying them to the user's situation. S*P*A*R*K can offer the following: a detailed examination of the example itself; various brainstorming techniques; and/or help positioning the example vis-a-vis some previous conceptual frameworks that had been utilized.

The goal of the example presentation and the analysis is to help users find ideas for using IIT in their own situations. There is no attempt to evaluate the ideas in terms of feasibility, economic advantage, or any other criterion. Help in generating many possibilities is the aim of S*P*A*R*K.

Implementation

One of the primary concerns in implementing S*P*A*R*K has been how best to handle the knowledge, both to represent any one body of information and to deal with multiple sources. Another key concern has been how to provide a great deal of flexibility in selecting ways to proceed. At the same time we have the problems of stimulating the user's creativity and making the system easy to use, readily accessible, and portable.

Knowledge representation. The knowledge embodied in S*P*A*R*K is somewhat ambiguous, far from complete, and mathematically imprecise, and at the same time it is representative of many areas of expertise. In other words, it reflects real-world business situations.

To handle this type of knowledge, we use a hybrid knowledge representation scheme based on both frames and rules. *Frames* are knowledge structures that represent the knowledge units of the system. A frame represents a whole concept, that is, a main idea or object and all of its associated properties. For example, a conceptual framework like the customer resource life cycle is a frame as are objects like market, product, or supplier. Rules use an if–then form to specify relationships among the properties of the frames. Thus, rules can create relationships among frames and within frames.

Each of the conceptual frameworks is a separate knowledge source and maintains its own separate coherence within the larger system. The knowledge inherent in each framework is not melded with the others, but has its own distinct frame representation. All the frameworks plus additional business and IIT knowledge make up the static knowledge base of S*P*A*R*K.

Flexibility. There is no one best way to think about business situations. Various approaches to analyzing strategies, examining marketplace situations, and looking at internal business operations are relevant under different conditions. Therefore, we provide a number of different conceptual approaches in the static knowledge base. We also provide an environment that allows flexibility in deciding which approaches to pursue at which points. This flexibility is needed across user sessions in S*P*A*R*K, and it is also needed for single users who may want to analyze alternative scenarios or to change assumptions about the company's situation, all in a single session.

We handle the need for flexible selection among conceptual frameworks by using a blackboard approach[12] in which each knowledge source brings its own expertise to a situation. The knowledge sources interact to reach an overall solution to the problem at hand by accessing a common global knowledge base, which is the blackboard. It contains all the information obtained or used in a particular session. In the case of S*P*A*R*K, this is information on the overall company situation plus the knowledge incorporated in the selected conceptual frameworks.

Thus the blackboard is the dynamic knowledge base for the session.

We plan future enhancements that will allow different lines of reasoning to be carried out in a single session by taking a multiple-worlds or multiple-viewpoints approach. In other words, S*P*A*R*K will be able to pursue competing hypothetical pathways leading to the characterization of a firm's situation. This would allow the user to explore different possibilities corresponding to a firm's making different decisions about using IIT. These possible pathways could then be analyzed and compared with existing examples of IIT use and could prove helpful in the idea generation process.

The process begins by the S*P*A*R*K facilitator's interacting with the user in a question-and-answer mode. It asks for information about a firm's overall situation in order to determine a preferred line of reasoning. To make this determination, the facilitator uses knowledge about the conceptual framework that is most relevant under a given set of conditions, and knowledge of the relationship of the attributes of the current situation to the conceptual frameworks.

When the facilitator has selected an appropriate framework as a way to proceed, it suggests the method to the user, who can decide whether to accept the suggestion.

If the user accepts the suggestion, the facilitator presents the framework's logic or method through a series of questions. After answering the questions, the user is immediately given the result of an analysis of the responses, perhaps a rating of a product's competitive position, or a suggested business strategy. The user then chooses from a range of options, such as view examples related to the result or previously-viewed examples; select another framework; change the answers for the completed framework to see new results; select another business area (e.g., another product).

Creativity. The goal of S*P*A*R*K is to help people acquire ideas for competitive uses of information and information technology. Although we do not suggest that a system can make a person creative, we do think that some aid can be provided to stimulate ideas. For example, the conceptual frameworks provide multiple ways to view a problem, and a shift in perspective certainly can trigger new ideas on handling a situation. S*P*A*R*K's main aid, however, is the set of examples showing how others in similar circumstances made use of IIT to tackle problems or to exploit opportunities. This IIT example database underlies the reasoning by analogy.[11]

The database consists of about three hundred examples that can be augmented at any time. The examples are retrieved through attribute criteria used in the browser and the facilitator. They are accessed via a tree structure that corresponds closely to the structure of the knowledge base. Each example in the database details information about a real organization that uses IIT in a strategic or competitive fashion. Some example applications are shown in a portfolio at the end of this paper. We have represented the examples graphically, using pictures similar to Storyboard Plus.[13] Each example has a summary picture that details the main points of the competitive IIT use. Many examples, because of their complexity, are illustrated by a series of pictures and simple animation to create a story about the IIT application. A voiceover for each picture (via a digital voice recording) provides more description about the firm and its IIT situation. The user can hear the descriptions while viewing the pictures. In fact, users can hear a recording then play back parts or all of a story several times. This gives users the chance to fully understand the example and to think about how the example IIT use might fit their own situations. If a user does not have a voice capability, a text version is provided. As knowledge about a firm accumulates during a session, the facilitator continually changes the set of examples matched to the user's situation. The facilitator allows the user to see this new set of examples at many steps during the consultation and not just at the end of a long series of questions.

Each example in the database details information about a real organization that uses IIT in a strategic or competitive fashion.

At any point in a session, users can jot down their ideas in an electronic notepad, which is always avail-

able at the touch of a function key. This notepad is also shared by S*P*A*R*K itself. As S*P*A*R*K reaches various junctures, it makes entries in the notepad to serve as stimuli for the user and as an organization guide to keep track of things the user has done.

Ease of use, accessibility, and portability. For accessibility by our primary audience of business and I/S managers, we built S*P*A*R*K in a workstation environment, using OS/2 on the PS/2. We chose an object-oriented approach for implementing our knowledge structures because it provides a fairly natural way to model the real world and to depict the relevant frames and rules. For our situation, object-oriented code, when compared with conventional approaches, is both concise and well-structured. This results in easier enhancement, maintenance, and portability.

We chose an object-oriented approach for implementing our knowledge structures because it provides a natural way to model the real world.

We use the programming language C++®, which can be considered an object-oriented extension of the C language. C++ provides higher run-time efficiency than interpreted object-oriented languages. Also, because the various implementations of the C and C++ languages are comparatively well-standardized, the process of porting an application to other environments should not be too tedious. This is an important consideration, given the rapidly developing software and workstation markets and the continuing needs for further developments in environments like OS/2.

For ease of use, we decided on a windowing environment for the user interface, which is built on top of a predefined library of C++ window classes. The windows contain either menus or text. Besides offering a list of general commands, the menus provide for selection among the S*P*A*R*K modules, possible answers to the facilitator's questions, examples proposed for further investigation, and selection criteria for the examples in the browser. Upon the request of the user, the windows with text provide general help information and detailed explanations of the facilitator's questions. The windows also give insight into the reasoning strategy for users who want to know why a question is asked. Finally, the electronic notepad acts as a window for recording users' ideas and the system's recommendations.

Portfolio of example applications

At the end of this paper, we present a portfolio of example applications that are based on published information. This portfolio consists of thirteen IIT examples from the S*P*A*R*K database to provide a sense of the stored examples and to illustrate some of the features of the database. Each example is classified according to a set of attributes. Table 2 shows four such attribute categories that are used by the browser module: line of business, focus (business strategy focus), target (business strategy target), and IIT use (information and information technology use). Table 2 also shows the thirteen IIT example companies classified according to these attributes.

For example, consider the Microsoft categorization in the table. This line of business (LOB) is information/communications. The focus is on changing the firm's internal process or organization, differentiating its products and services and improving product quality. The targets are its customers and its own internal processes. IIT is used to automate activities and to facilitate the firm's linkages with its customers.

Both the browser and the facilitator modules allow access to the examples. In the browser, the user can select any one attribute and the browser will match appropriate examples. For instance, Table 2 shows that the browser selects six examples for a user who is interested in targeting customers, three if the line of business is related to money, four if IIT use is automating linkages, and two if the focus is on improving distribution channels.

In the facilitator module, the system decides which examples to suggest, using knowledge of the situation and of the selected conceptual frameworks. The attribute list for classifying examples is correspondingly longer than that in the browser. However, in both the browser and in the facilitator the presentation of examples is similar.

Table 2 Attributes of IIT examples

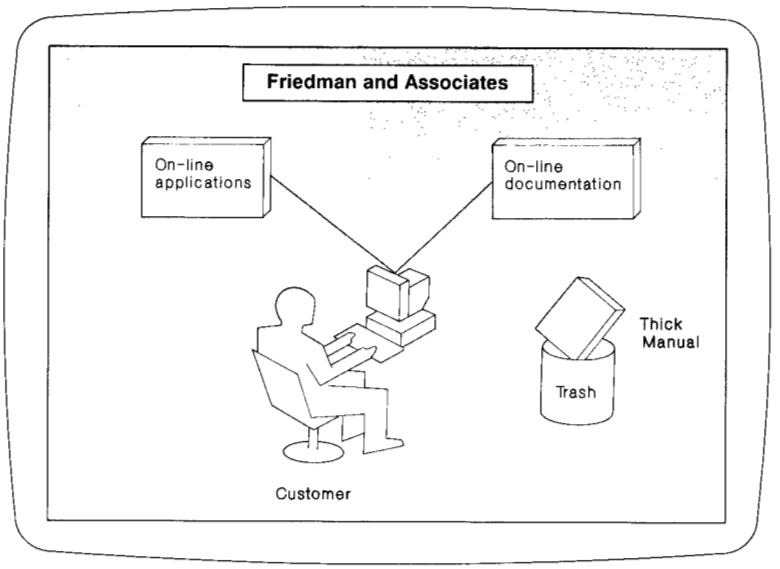
Attributes	Examples	Friedman	PIE	E.F. Hutton	Otis	Chase	TWX	Microsoft	Citibank	Qantas	Kroger	Allen	Pharmaceutical Company	Caterpillar
Line of Business	Materials and Equipment		Y		Y		Y				Y	Y	Y	Y
	Energy		Y											
	People									Y				
	Information/Communication	Y						Y	Y					
	Money			Y		Y			Y					
Focus	Process/Organization Change							Y				Y		
	Process/Organization Productivity					Y				Y		Y	Y	
	Product Service Creation			Y										
	Product Service Differentiation	Y	Y	Y			Y	Y	Y		Y			
	Product Service Quality							Y						
	Growth					Y								
	Marketing Improvement													Y
	Market Segmentation			Y	Y									
	Distribution Improvement										Y			Y
Target	Customers	Y	Y	Y			Y	Y	Y					
	Suppliers									Y				
	Rivals				Y									
	New Entrants											Y		
	Substitute Products			Y										
	Distribution Channels													Y
	Regulatory Agencies												Y	
	Allied Companies										Y			
	Your Own Company		Y	Y		Y		Y				Y		
IIT Use	Activity		Y	Y		Y	Y	Y						
	Linkage		Y				Y	Y						
	Information			Y	Y		Y		Y	Y	Y		Y	
	Product	Y												

Based on the presented list of example names, the user decides which of the examples to view and chooses between a summary picture and a story. Examples 1 through 13 are illustrated with summary pictures for the thirteen selected examples. In S*P*A*R*K, the accompanying text for each example would be heard rather than read. Example 14 is the expanded story version of Example 6, minus animation. Again, the accompanying texts would be heard rather than read. All the examples in the database have summary pictures, but only a subset that contain complex information have stories.

Portfolio of IIT examples

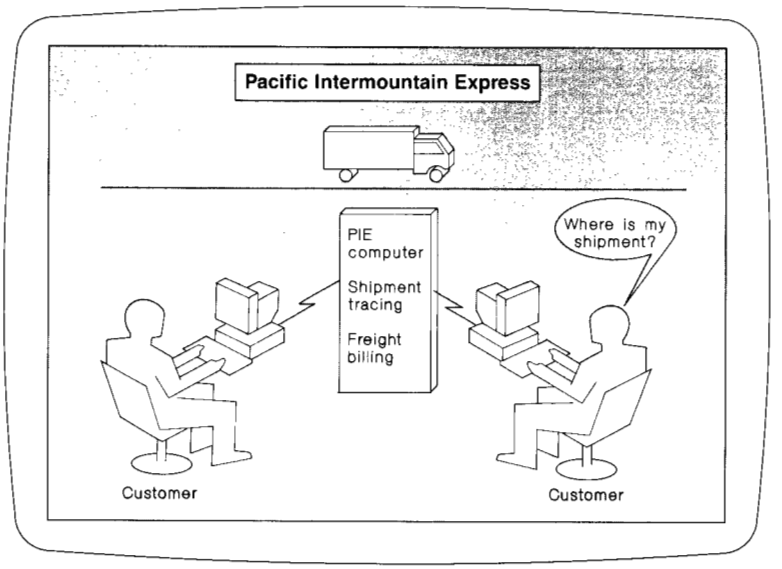
Example 1 Friedman

Friedman and Associates is a software vendor that differentiates its software products by building in an on-line documentation and help feature so that the customer can use a HELP key to display easy-to-read documentation.[14]



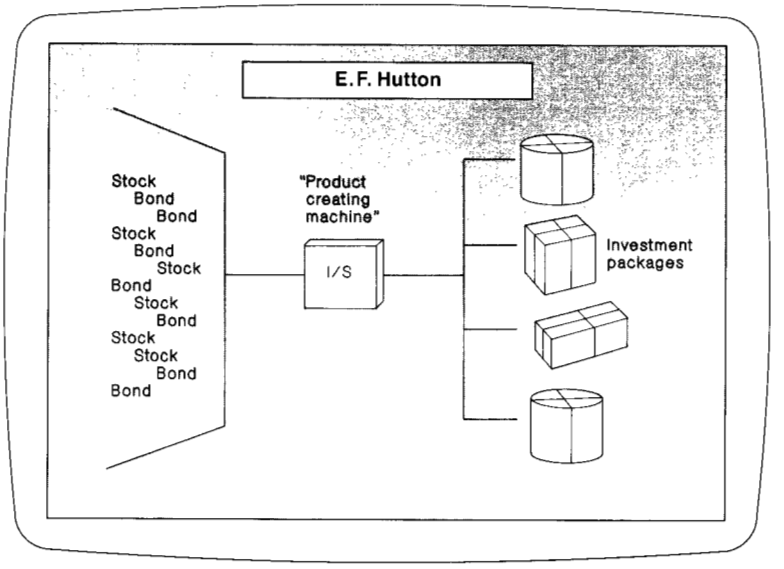
Example 2 PIE

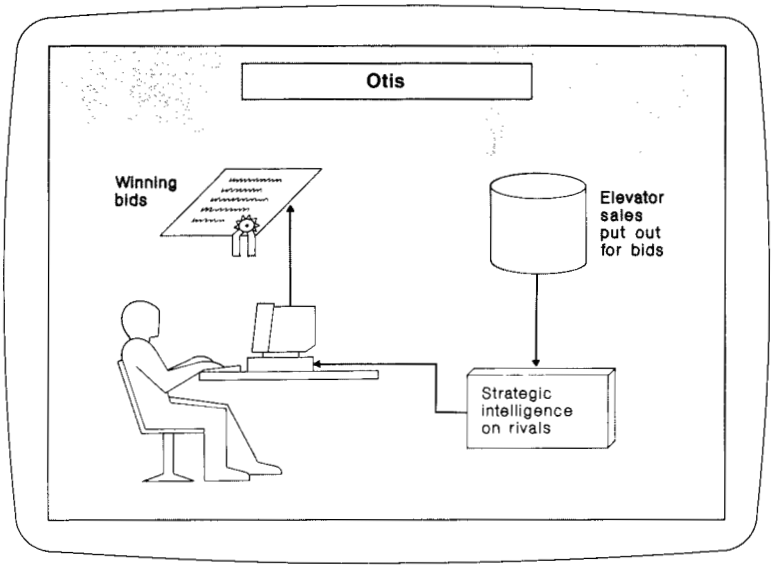
Pacific Intermountain Express, a large trucking firm, sets itself apart from its competitors by investing in an on-line computer system so that its shippers can trace their shipments. The system also provides reports on over-the-road costs, empty miles, and inbound shipments.[15]



Example 3 E.F. Hutton

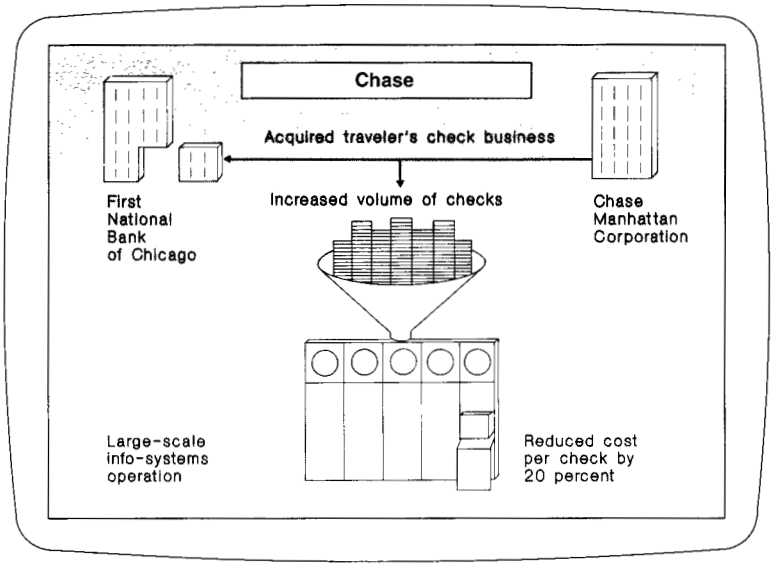
E.F. Hutton & Company, Inc. is an investment house that uses information technology to help create new financial products that are offered to the investment public as substitutes for those products offered by its competitors.[16]





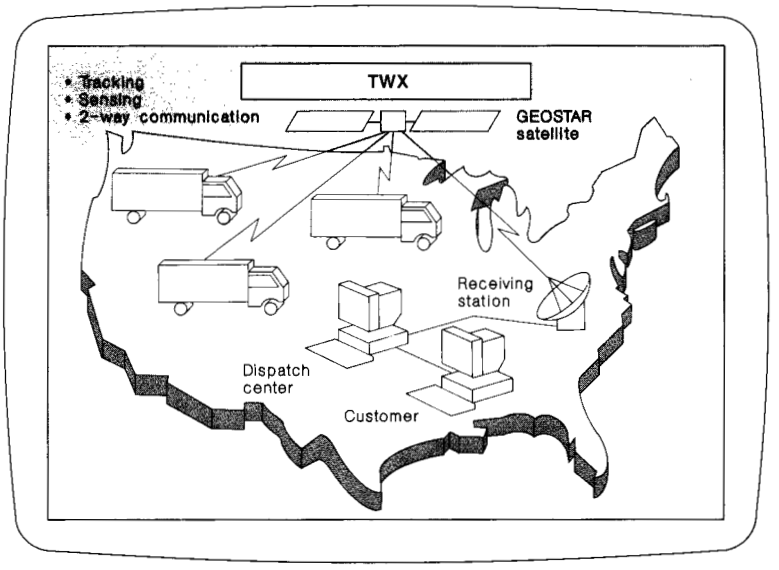
Example 4 Otis

Otis Elevator Corporation tracks all elevator sales put out for bid in order to gather strategic intelligence about its rivals and to enable it to track its negotiations from bidding through contract award.[17]



Example 5 Chase

Chase Manhattan Corporation, a large banking institution, achieved economies of scale in its credit card processing by buying a large traveler's check business. This acquisition reduced its cost per processed check and increased its revenue from the float.[18]

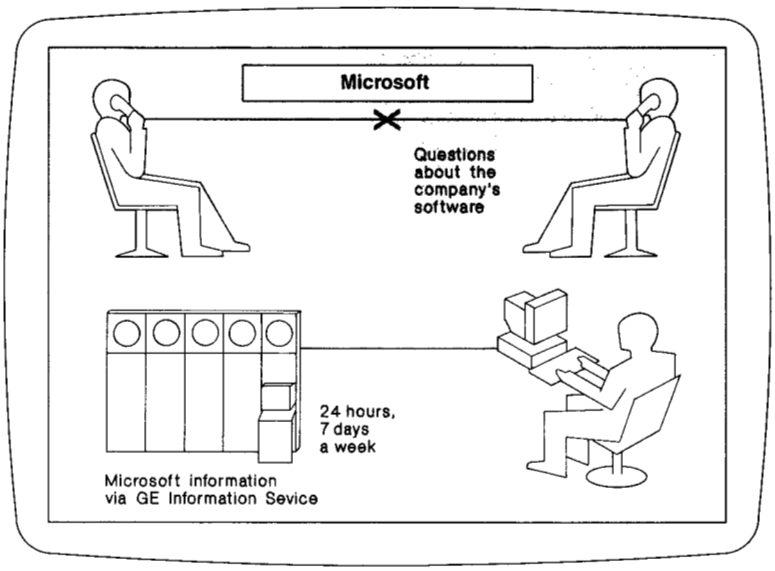


Example 6 TWX

Trans-Western Express Ltd. uses satellite tracking and communication technology to enhance its service as a reliable and just-in-time carrier (a carrier that delivers exactly when the manufacturer needs it).[19]

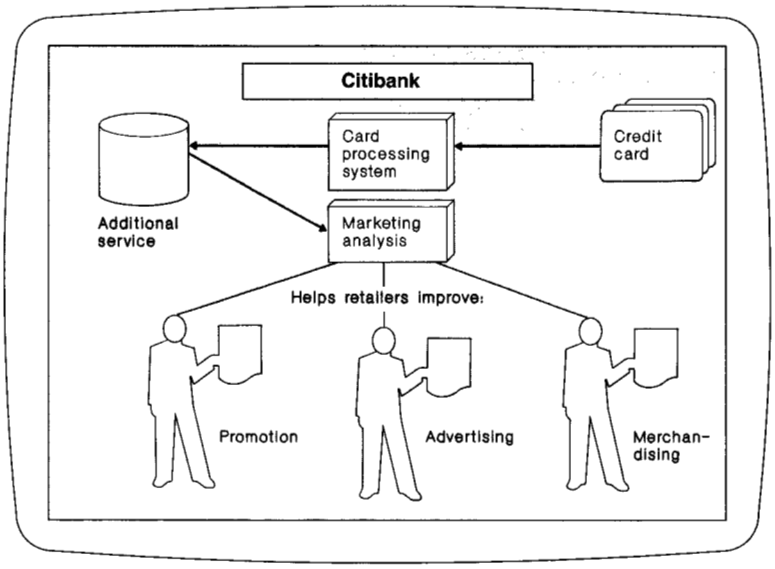
Example 7 Microsoft

Microsoft Corporation, a large software company, uses an external computer-based information service to hold a database of answers to frequently asked questions about its products. Customers can dial this service for help rather than calling the company itself.[20]



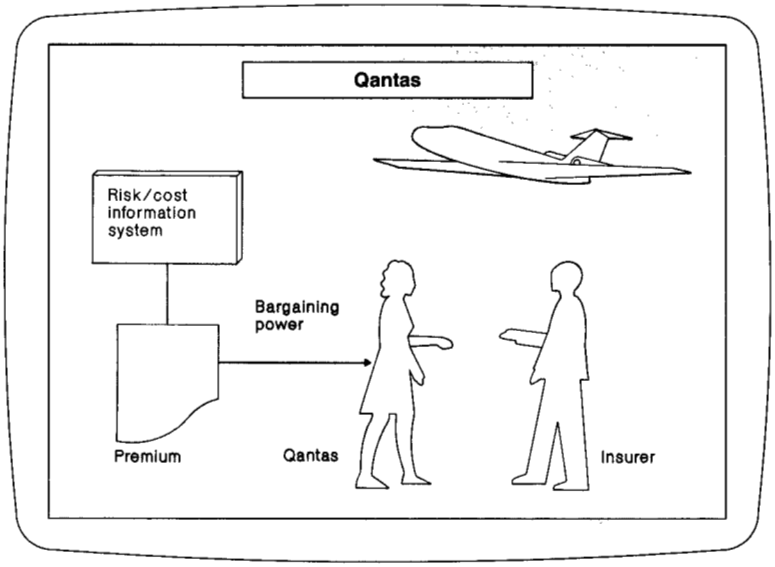
Example 8 Citibank

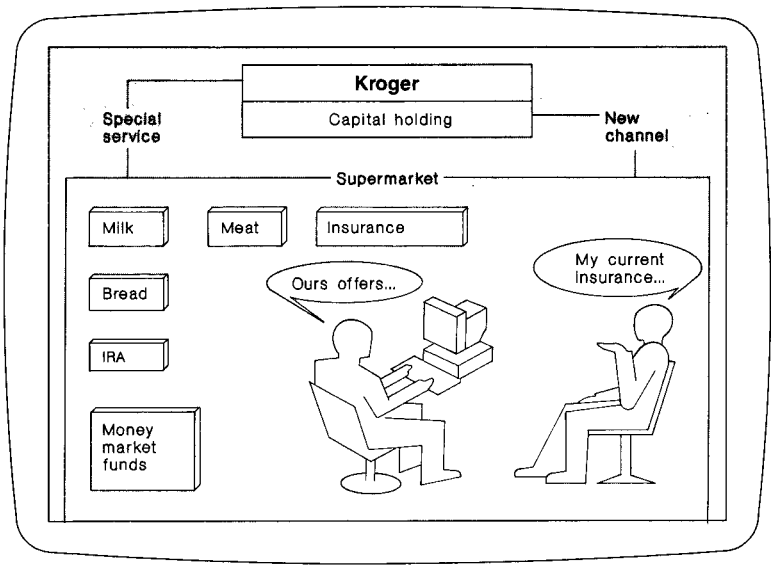
Citibank N.A. has developed a business service that offers a series of marketing reports to retailers intent on improving their merchandising, promotion, and advertising. The marketing reports use statistics gleaned as a by-product of Citibank's credit card processing operations.[21]



Example 9 Qantas

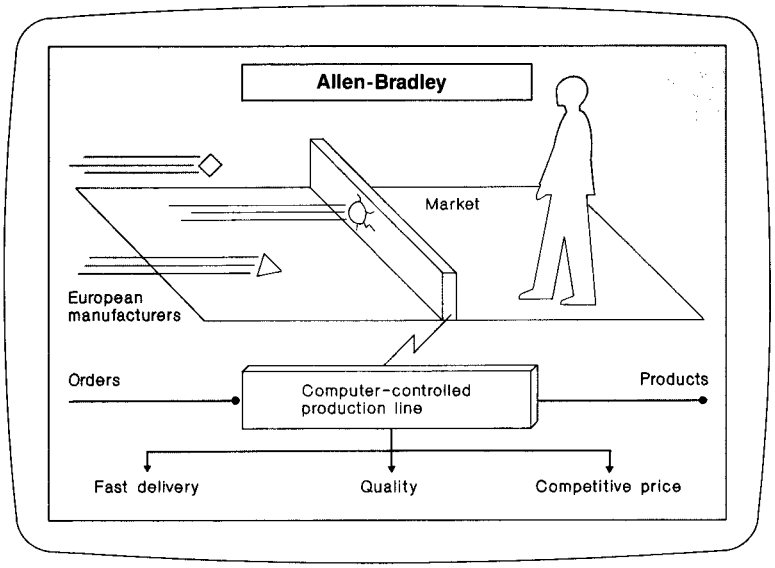
Qantas Airways has developed an information system to model air risks for accidents in the air, on the ground, and to passengers, and has used that model to renegotiate and obtain lower rates from insurers.[22]





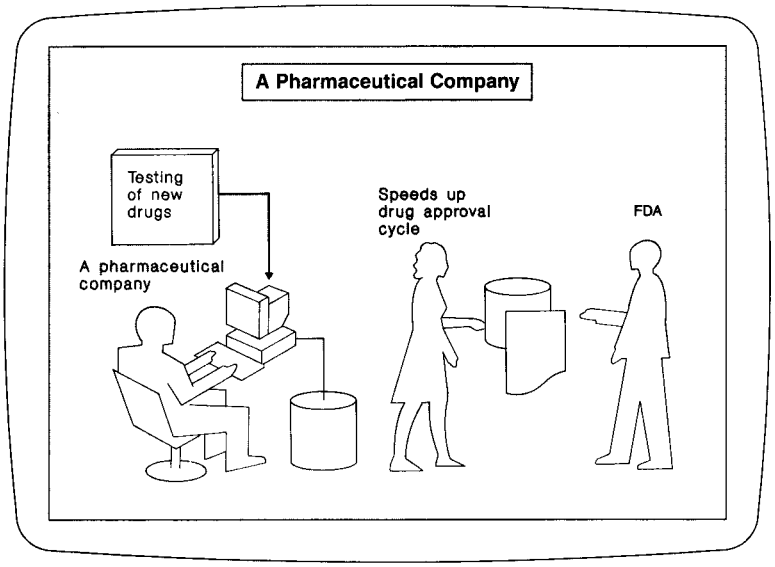
Example 10 Kroger

The Kroger Co. is a supermarket chain that has allied itself with financial institutions to sell insurance, money market funds, and IRAs in its stores. Thus the retailer offers more services to its customers, and the allied financial institutions gain new distribution channels.[23]



Example 11 Allen-Bradley

Allen-Bradley Co. is a U.S. electrical equipment manufacturer that uses information technology to build a computerized production line to boost its ability to compete with foreign entrants into the U.S. market.[24]

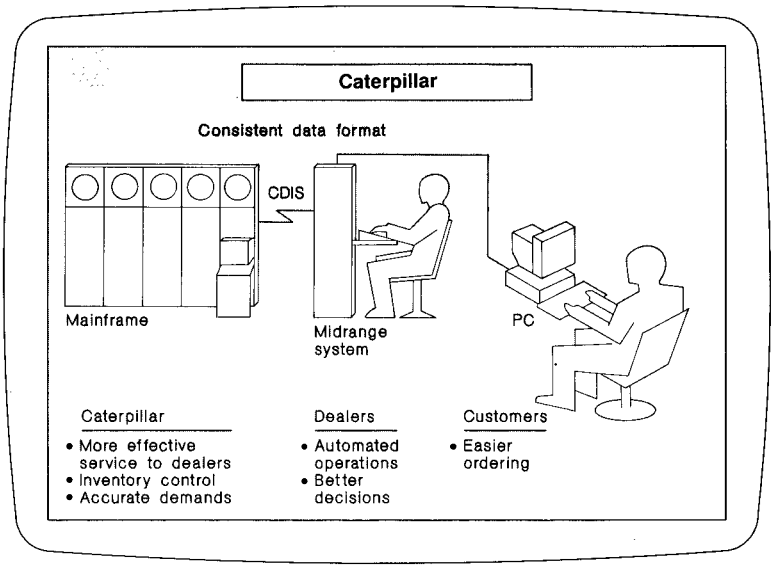


Example 12 A Pharmaceutical Company

A pharmaceutical company sends its applications for new drug approvals, together with the test data acquired and the computer programs used, directly to the Federal Drug Administration (FDA). This speeds up approval processing.[25]

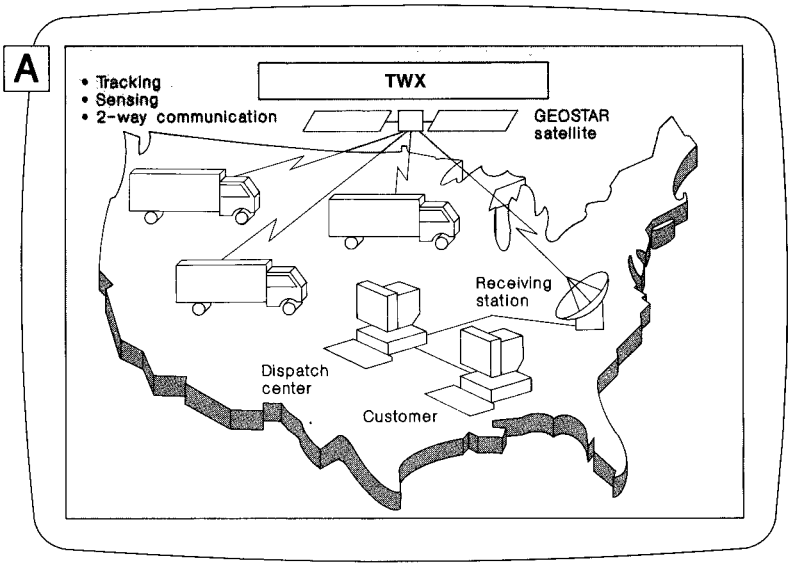
Example 13 Caterpillar

To respond to a changing market environment, Caterpillar Inc., a construction and farm equipment manufacturer, uses information technology to decentralize its marketing support to district offices. This strengthens its distribution channel through an increased effectiveness with Caterpillar's dealers and headquarters.[26]

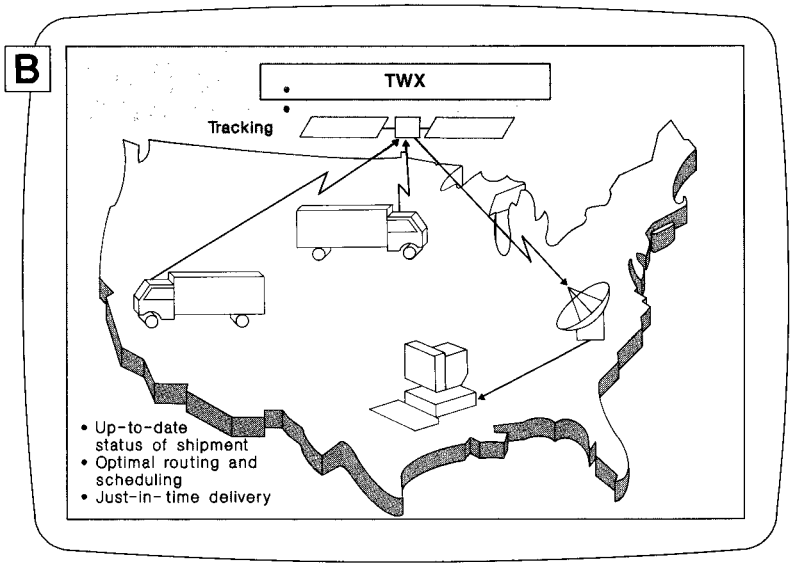


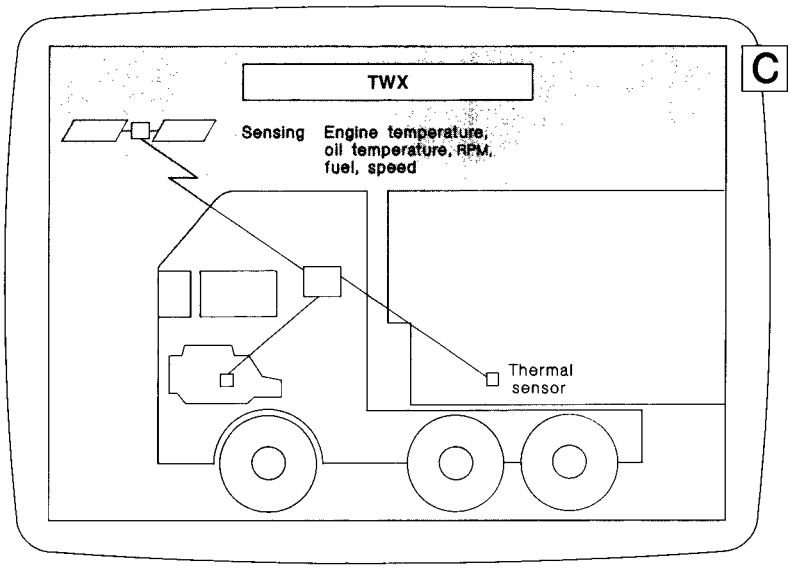
Example 14 Trans-Western Express (TWX) story.[27]

(A) Trans-Western Express Ltd. uses satellite tracking and communication technology to enhance its service to customers as a reliable, just-in-time carrier.



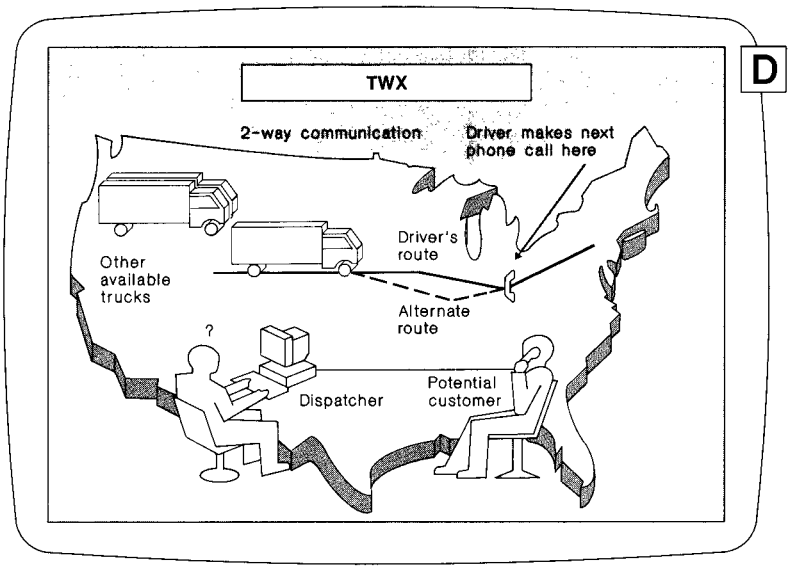
(B) Tracking the trucks: The position of the trucks is updated every hour and mapped to an overall picture in the central dispatch office. The drivers no longer stop to make check calls, which used to cost valuable time.



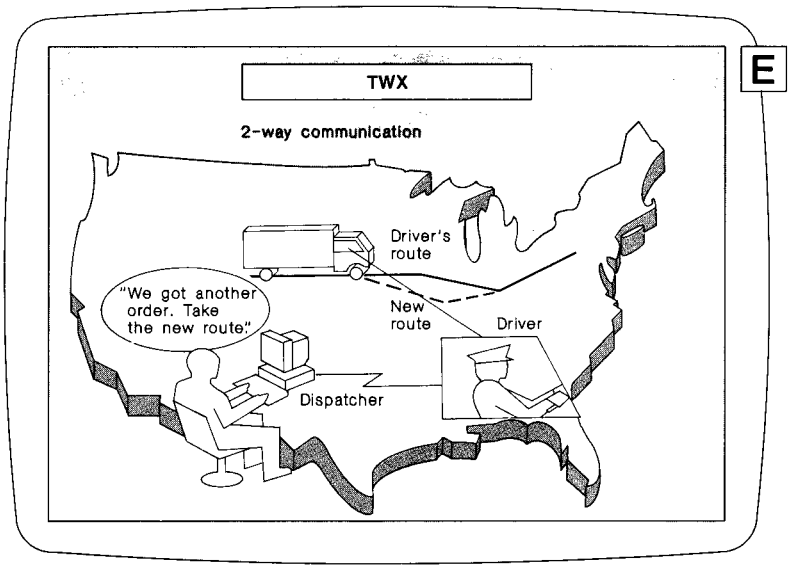


Example 14 Trans-Western Express (TWX) story (continued)

(C) Sensing the state of goods and vehicles: Data acquired by on-board cargo and vehicle sensors can be tranmitted. Monitoring the temperature of refrigerated cargoes and data on the performance of the engine maintain high efficiency in the timeliness and quality of the transport service.



(D) Before two-way radio communication: For irregular-route operation, drivers had to make check telephone calls at certain designated points along the route. This often resulted in the loss of orders or having to send extra trucks, when a change of route was all that was needed.



(E) With two-way radio communication: With two-way communication between the dispatcher and drivers, the truck nearest a potential customer can be located and given rerouting instructions to pick up the new order.

Concluding remarks

We have presented an overview of S*P*A*R*K, including conceptual frameworks used for the knowledge base, design philosophy, functions, and implementation approaches. Examples from the database of competitive applications of information and information technology (IIT) have also been shown.

With current technology, S*P*A*R*K cannot be as effective as a good human teacher or a good human facilitator in such creative endeavors as leading group discussions. However, S*P*A*R*K has the value of allowing users systematically to address strategic issues from different perspectives, reaching wide audiences within organizations and being constantly available for use.

Although S*P*A*R*K is a knowledge-based or expert system, it differs from most existing expert systems which tend to be diagnostic in nature, taking the user from a broad range of alternatives to a specific assessment of the problem or a recommended solution. Instead, the S*P*A*R*K goal is to help generate a broad range of potential alternatives that we hope produces a ripple effect of creativity. We believe that a system such as S*P*A*R*K can become accepted as one of a firm's business analysis and planning tools.

We think that IT marketing organizations and educational institutions, such as university business schools or customer education centers, can benefit from using S*P*A*R*K. We believe that S*P*A*R*K may be of help whenever people within organizations need to think about strategic uses for information and information technology.

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The C++ system is a registered trademark of American Telephone and Telegraph, Inc.

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16. *Ibid.*, p. 187.
17. *Ibid.*, p. 191.
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22. *Ibid.*, p. 216.
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