

# Intelligent marketing information systems: computerized intelligence for marketing decision making

*Chandra S. Amaravadi, Subhashish Samaddar and Siddhartha Dutta*

**Intelligent marketing information systems offer a way for marketing managers to share knowledge and expertise**

## Introduction

The presence of international competition and the opening up of protected international markets such as the Soviet bloc, China and India emphasize the need for effective marketing strategies. The successful companies in this environment will be those which can sell standardized products at lower prices in global markets (Levitt, 1983). Such a strategy requires a centrally co-ordinated marketing team. It also implies the need for an instantaneous and transparent flow of information between the points of sale (PoS) and the decision makers and the sharing of expertise between decision makers in different regional markets (Higgins *et al.* 1991). Information from markets has assumed greater importance as a strategic corporate asset and organizations cannot afford to be slow in collecting and processing this information. Technological and marketing innovations such as universal product code (UPC) scanners are reducing traditional barriers such as the time taken for data entry, the cost of collecting market information and the time taken to process these huge volumes of information. Customer needs can be met more effectively with the assistance of technology (McKenna, 1991). For example, Frito-Lay has established a decision support system to handle problems created by an expanding product line such as slow growth of profit margins, increasing competitive pressures and problems in product monitoring and cost control. Marketing managers are more open to information technologies such as electronic data interchange (EDI), decision support systems, and advanced database systems, motivated by the need to remain competitive and the need to manage information resources (Carlyle, 1988).

The combination of marketing information, computer technology and changing managerial consciousness for

time and cost-effectiveness forms a dynamic system known as marketing information systems (MkIS) (Schmidt, 1993). The utilization of MkIS resources is crucial to the success of an organization and should be an integral part of the strategic planning process (Rockart and Morton, 1984). In this article, we introduce intelligent MkIS as a decision-making aid for managers. Unlike an MkIS, an IMkIS addresses the need to share marketing expertise in a competitive marketing environment. It makes use of artificial intelligence technology to represent and process assorted marketing knowledge. As an introduction to IMkIS, we will first discuss MkIS and its limitations.

## Key shortcomings of MkIS

The concept of an MkIS to process and supply information to marketing personnel has been extant for some time now (Cox and Good, 1967). The general system elements for any MkIS include a data acquisition system, database management system, graphical and statistical analysis tools, model base, directories (specific data elements/information classification schemes) and retrieval systems (Barabba, 1983). According to one study, over three-fourths of the *Fortune* 1,000 firms utilize MkIS for decision making (McLeod and Rogers, 1985). However, these systems do little more than process information mechanically and presumably at considerable expense (Bessen, 1993; Schmidt, 1993). The large volumes of information implied by such systems do not serve management needs and can overwhelm and confuse potential users. Another study in fact showed that

We would like to acknowledge the comments by professors Rolf Hackmann, Jim Kenny and Caroline Tripp at Western Illinois University. This project was funded in part by a grant from the State Farm Insurance Company. We are grateful to our sponsors.

organizations rely on their salesforce for informal feedback rather than on their formal systems (Evans and Schlacter, 1985). The article cited the complexity of present systems as a factor in reducing their effectiveness. Systems with natural language capabilities and filtering capabilities would undoubtedly contribute towards more effective usage of MkIS. But in order to serve management's needs, systems require a deeper understanding of marketing issues.

There have been attempts at enhancing MkIS with decision support and expert capabilities. A marketing decision support system (MkDSS) is a co-ordinated collection of data, systems, tools and techniques with supporting software and hardware (Little, 1984). For example, "Benemax" is a MkDSS based on Brien Stafford and Crissy Mossman models and is used to optimize product features/benefits with target audience characteristics (Green *et al.*, 1983). The Brien Stafford model has subsystems for each ingredient of the marketing mix, namely product planning and development, pricing, channel/distribution and promotion strategies (Brien and Stafford, 1968). The Crissy Mossman model shows how marketing-mix subsystems assist marketers in addressing major planning questions (Crissy and Mossman, 1977). Current literature suggests that there are MkDSS applications for separate marketing mix subsystems although they do not refer to MkDSS, *per se*. A major limitation of MkDSS is that they rely on limited quantitative models (McLeod, 1990). Being quantitatively oriented, MkDSS cannot handle marketing situations where complete information is not available. Since its problem-solving area is traditionally more limited than MkIS, it is also unable to provide responses in various marketing mixes. An integrated marketing-mix model has always been elusive (Schmidt, 1993). MkIS with expert system capabilities have also been limited.

Expert systems (ES) are a branch of artificial intelligence concerned with capturing the expertise of human experts with thumb-rules of the sort: "If situation A then action B". They can provide conclusions/recommendations for various situations and have built-in explanation facilities to explain how they arrived at their conclusions (Kirsh, 1992). Schwoerer and Frappa (1986) suggested the use of ES in new product development, media planning and copy evaluation. Kastiel (1987) proposed using ES in evaluating consumer and industrial promotion evaluations for direct mail/telemarketing situations. The ES approach overcomes the quantitative limitation of MkDSS, yet it has its own limitations. For example, "innovator" is an ES that can assess the success potential of new products in the financial services industry and provide a go/no go/re-evaluate decision to the user (Proctor, 1991). However, the system has problems in knowledge acquisition and knowledge representation; for example, the attribute weights are fixed and so the

system's flexibility to respond to different situations is limited. ES cannot be developed for semistructured problems, such as new product screening, owing to a shortage of experts with proven records (Durkin, 1994). Since knowledge in an expert system is in the form of rules, only well-defined situations, which lend themselves to rules, can be modelled. ES are aimed at one problem and cannot function outside their domain area. It is also difficult to extract knowledge except in the form of a diagnosis, or in the form of reasoning/explanation or as rules. Lastly, it is difficult to develop and maintain ES because of the interdependence between rules and the procedural (step-by-step) nature of the knowledge (Barr *et al.*, 1981).

## The distinguishing feature of IMkIS is its knowledge base

The extent to which expert systems or decision support systems can support management is therefore debatable. Marketing situations require integrated models owing to interdependencies in modern business environments which MkDSS are unable to provide. They require representation of "soft", i.e. non-quantitative situations (Durkin, 1994). ES are not effective because of their philosophy of being aimed for a single use and their inability to function outside their area. We propose the concept of intelligent MkIS (IMkIS) as a method of supporting marketing decision making. It is an extension of the MkIS-MkDSS concept in that it uses techniques of knowledge representation from the field of artificial intelligence. An IMkIS has much the same capabilities as an MkIS-MkDSS. It provides marketing personnel with access to online databases and various types of reports for decision making such as product performance, market segment sales, promotion, distribution, product mix positioning, competition, etc. The database and reports are based on considering IMkIS as part of an existing marketing system. The MkDSS capabilities are geared towards dealing with semistructured problems with the help of built-in models for customer profile analysis, sales forecasting, budgeting, order processing, pricing decisions, competitive analysis, salesforce analysis, inventory control, etc. (Higby and Farah, 1991). The distinguishing feature of IMkIS is, however, its knowledge base. In general, the knowledge base contains knowledge about various aspects of marketing. For example, PepsiCo markets "Allsport", a new product, as a sport drink using celebrities like Shaquille O' Neal for national network television advertisements during the National Basketball Association (NBA) playoffs. At the

same time, it uses vending machines and retail outlets for national distribution. This knowledge is encoded in the system using an appropriate representation scheme. The MkIS elements such as databases and reports address routine information requirements, the MkDSS aspect handles routine decisions, while the knowledge-based aspect handles situations requiring knowledge/experience. If the essential aspects of marketing situations are captured in a knowledge base, it would serve as a powerful decision aid by enabling expertise to be accessed freely.

### Framework of IMkIS relationships

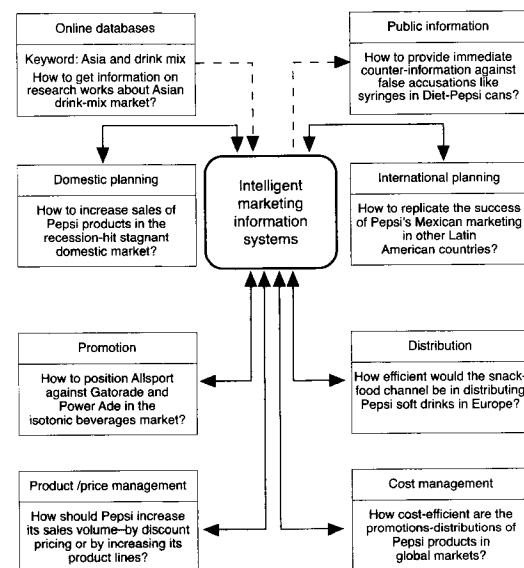
Marketing is an ongoing process in which decisions are made and the results of these decisions are monitored continuously. Marketing managers have to correct deviations from plans as well as change plans when market conditions change (Kotler, 1988; Levitt, 1983). Carrying out these actions requires information about the market and its characteristics, such as information about competition, prospective customers and performance in each segment. This should be reflected in the IMkIS design, specifically the database and reports. Marketing managers also obtain information from product management groups about their customers and product segments. Based on this information, they can plan for domestic and international markets. They have to take into consideration issues of product positioning, pricing, promotion (which includes advertising) and distribution in their strategic plans owing to the strong interrelationship among these groups. At the same time, marketing managers have to monitor the department costs with respect to the allocated budget. For an IMkIS to be effective, these relationships must be reflected in its design. We will illustrate such relationships with the help of a case study of PepsiCo, Inc. (adapted from Thompson and Strickland's (1993), case number 18 – the details of the case can be found in the Appendix):

PepsiCo is a diversified firm in the soft drink (beverages, concentrates and syrups), snack foods and restaurant (full service, delivery and carry-out) business segments. It enjoys a tradition of success based on its cost controls, innovative advertising, aggressive promotion and distribution power. It entered the 1990s faced with increased competition for market share from its competitors through ad wars, new product introductions and price discounts. Faced with strict competition, and the need to remain the best consumer products company, PepsiCo is resorting to intensive advertisements and sales promotions, new product introductions and cost cuts while strengthening its distribution networks. It is also attempting to transfer expertise from its successful segments like Frito-Lay and Pepsi Cola to other segments of the corporation. In the past, CEO Wayne Calloway (himself a Frito-Lay alumnus) has emphasized rotating management personnel from Frito-Lay to other business units. However, incumbent management personnel take time to adjust to new organization cultures and may not enjoy as much support as in their previous positions.

Figure 1 illustrates the various groups/sources with which the marketing manager has to interact. These include online databases, domestic planning, promotion, product/price management, public information, international planning, distribution, and cost management. Let us consider these in the context of the example of PepsiCo promoting its Allsport soft drink in the isotonic beverage market (sports-drink market). In such situations, marketing managers have to identify various distribution channels so that the product reaches the customers. It implies consideration of the impact of promotion on the distribution sector. The cost-efficiency of promotions has to be evaluated on the basis of some benchmark (e.g. previous promotion history). This shows the impact of the cost management group on the marketing manager's decision. However, consumer goods cannot be promoted unless they are produced, which brings in the involvement of an interfunctional team of manufacturing, quality control, engineering, research and development, test marketers and pricing strategists. Finally, the marketing manager has to provide adequate public information about new products to financial institutions, for example, so that investors are aware of how their money is being invested. The advantage of promoting this product in international markets, for example in tropical countries, can also be considered by marketing managers as a part of a long-term strategy.

Thus there are eight major groups within an organization which impact on marketing decisions: online databases, domestic and international planning, product/price

Figure 1. IMkIS relationships



management, promotion, public information, distribution and cost management. A marketing manager should therefore consider these interrelationships before making strategic decisions (Dickson, 1994). If these are reflected in the IMkIS (they are included in “database” and “library” components) it can assist in the successful assimilation of knowledge among the different segments of an organization. Firms such as PepsiCo can easily transfer such knowledge from successful segments of the company to the newer segments.

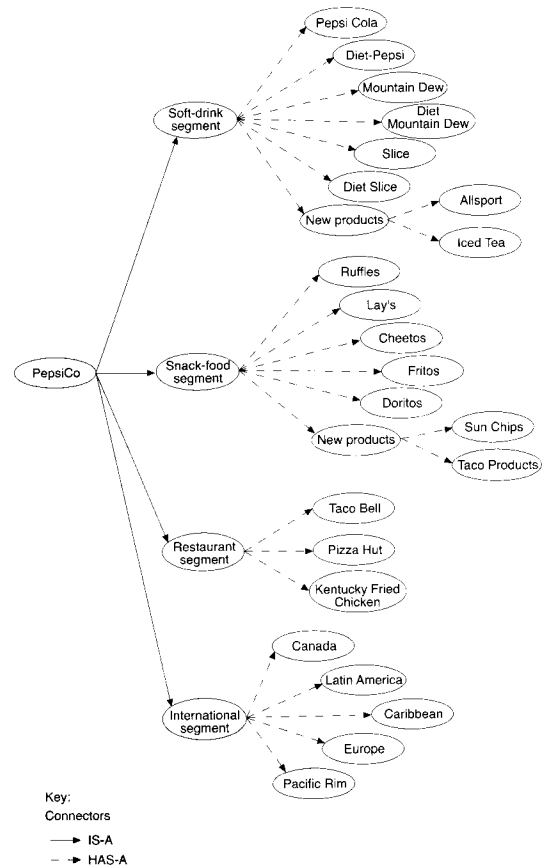
**An architecture for intelligent MkIS**

Figure 2 shows the essential elements of the proposed IMkIS and the manner in which they interact with one another. The library and database components reflect the framework discussed in the preceding section.

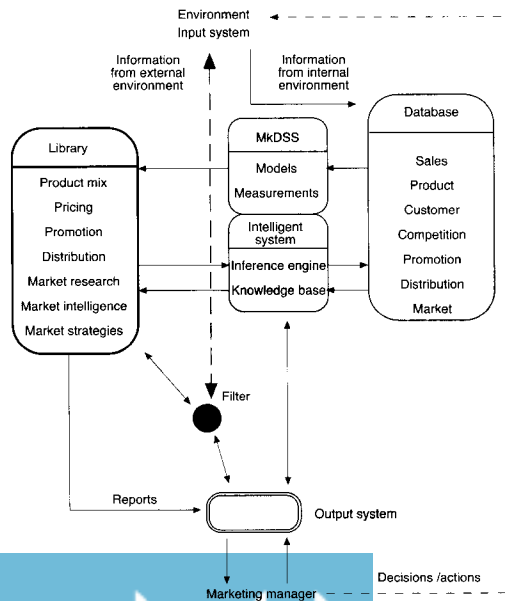
**Input system**

The input system collects data from the internal and external environments. The incoming data from the internal environment such as point-of-sale information, inventory/warehouse reports, purchase, shipment and sales orders, etc. are stored in the database. Sometimes, this information is available online through electronic data interchange. As shown in Figure 3, the input system for PepsiCo includes transaction information from all of its product segments such as Pepsi, Pizza Hut, Taco Bell, Kentucky Fried Chicken, Frito-Lay, etc. In addition, sales

**Figure 3. Input system**



**Figure 2. Architecture for IMkIS**



information from its international operations is also a part of its input system. The MkDSS uses the database to carry out analysis. Data received from the external environment, such as industry reports, new research reports, news about competition, stock markets, government policies, etc., through online databases are screened through a filter and electronically sent to the appropriate personnel.

**Filter**

A filter is a mechanism that distinguishes relevant information from irrelevant information (Malone *et al.*, 1987). It screens and accepts relevant information while ignoring irrelevant information. The relevance of incoming information is identified from the needs of management. Generally, the information needs of management are based on its goal structures such as increasing sales, market share, etc. (Amaravadi and



Kumar, 1994). Keywords are identified for various levels of management based on such goal structures. Incoming information is filtered and classified under different sections and sent to relevant personnel in the form of electronic mail messages (Malone *et al.*, 1987). For PepsiCo, information pertaining to competitors such as Coca-Cola Co. (soft-drink segment), Church's/Popeye's Fried Chicken (chicken segment), Domino's Pizza and Little Caesar's (pizza segment), Chi Chi's (Mexican segment), and Borden and Procter & Gamble (snack-food segment) is incorporated as keywords into the system. Also included is information from government agencies such as the Environmental Protection Agency, Federal Trade Commission, United States Department of Commerce, etc.; international agencies such as the GATT, World Bank, etc.; and news about consumer interests, tastes, lifestyles, entertainment events, etc. For example, managers can use "CISG" (contract for international sale of goods), "Europe" and "drink mix" as keywords to scan new CISG regulations on PepsiCo's soft-drink segment in Europe.

#### **Library**

The importance, usage and popularity of the different classes of reports requires maintaining an active database of machine-processable reports in the library. The automated librarian stores reports filed with various government and financial institutions, and significant news and internal reports from various meetings. Appropriate classification schemes are used so that they can be retrieved easily. The library can be queried for information regarding new measurement techniques or models relevant to marketing analysts who might select and customize them to their own needs. This can enable rapid access and transfer of information whenever required. Triggers are used to transfer automatically periodic reports to different personnel both within and outside the organization at definite time intervals. At PepsiCo, periodic reports from soft-drink/snack-food segments and daily reports from the restaurant business segment can be automatically maintained, updated and forwarded to designated personnel for management control.

#### **Marketing decision support system**

As already stated, MkDSS is a co-ordinated collection of data, systems, tools and techniques with supporting software and hardware for making marketing decisions (Lillis and McIvor, 1984). Managers interact with the system in a question/answer mode and information obtained from such sessions and from external databases is analysed with various types of models to arrive at decision recommendations (Proctor, 1991). The system can support "what if" type analysis to allow managers to change interactively model parameters by a trial and error process. The system can draw on textual information from the databases and display quantitative results with graphical and descriptive interpretations. For PepsiCo, MkDSS will probably use product-mix with distribution

models; industrial salesforce transaction and revenue gain forecasting models; product cost optimization and pricing models; market, customer, promotion and channel analysis models; market share change, simulations and interactive models, to name a few.

#### **Output system**

Managers can interact with the system through a terminal screen, to review reports and pose queries. These queries can be conventional database queries such as "what are the sales in the Midwest region for the last quarter?", or queries to the knowledge base such as "what are some of the advertising strategies used by Frito-Lay in the past?" As already stated, marketing decisions require interactive sessions, facilitated through a terminal with advanced display capabilities and a rapid response time.

#### **Intelligent system**

The intelligent system consists of a knowledge base and an inference engine. The knowledge base contains facts and knowledge about the firm's goals and strategies. In general, knowledge in a knowledge base is represented in the form of rules, frames or semantic networks (Bench-Capon, 1990). The rule-based scheme represents knowledge in the form of a series of "if-then" condition-action statements. The scheme is inflexible owing to the fact that rules are interdependent and therefore difficult to modify. The frame-based scheme uses a record-like structure to capture properties of objects and their relationship to other objects. Each frame represents knowledge about objects with "slots" or attributes. Slots are filled with values, e.g. a car frame would have, among other things, slots for "type" and "manufacturer". For a Ford Thunderbird, these would have the values of "Sports coupé" and "Ford", respectively. The frame-based scheme is suitable for declarative knowledge – knowledge that is primarily factual in nature. The semantic network is a collection of nodes that are connected by links to relate objects. The links correspond to slots in the frame-based scheme. Continuing with the car example to illustrate a semantic net, the nodes would be "car", "Ford" and "Sports coupé", with "manufacturer" and "type" as links. The problem faced by the analyst is to convert fragmented strategic knowledge into usable, machine-processable knowledge. In this regard, the semantic network has an advantage stemming from its associative nature. It associates objects together in much the same way as humans do (Bench-Capon, 1990). We favour using this approach, since marketing strategies are characterized by relationships and interdependencies more than anything else.

The inference engine uses the knowledge and processes it to draw conclusions. When knowledge is represented with a semantic network, the inferencing process involves traversing the network to discover relationships. For example, to continue with the car example, if the user

were to ask, “who manufactures a Sports coupé?”, we would first identify the “Sports coupé” node and see if it has “manufacturer” as its attribute. In this case, it does not, so we need to trace the links of “Sports coupé” node to see if it has any “owner” nodes and see if that node has “manufacturer” as a link type. It turns out that “Sports coupé” does have an owner node, “car”, and it has “manufacturer” as an attribute (link type). We can now draw the conclusion that Ford manufactures Sports coupés. Inferencing in a network can become complicated, especially if the link types are unrestricted. In the work presented here, we demonstrate our knowledge base by using only four link types. Between two objects A and B, the link types are explained as follows:

- “IS-A” – A is a type of B (for example, sports car is a type of car);
- “HAS-A” – A has a property/characteristic, B (for example, car has a characteristic of speed);
- “C-T” – A contributes to B (for example, options contribute to the price of a car);
- “U-T” – A uses technique/strategy B (for example, the power transmission in the car uses an automatic system).

These restricted link types impose a structure on the network, which facilitates inferencing. The choice of link types is a critical decision on the part of the analyst, reflecting his/her skill and intuition in structuring assorted knowledge gleaned from interviewing marketing managers. In the next section, we will illustrate the knowledge base and explain the type of inferences that can be drawn from it.

### An illustration of the knowledge base

As pointed out, the knowledge base is developed using the semantic network scheme restricted to the four link types. There are, however, two node types: goal nodes representing management’s goals such as profitability, productivity, market share, etc., and nodes representing variables such as advertising, testing, etc. Using this method, we developed the knowledge structure for PepsiCo and its holdings based on published reports from the trade literature. This is illustrated in Figure 4. For example, the article, “Why HR is turning to outsourcing” (see Appendix, note 20) pointed out that Frito-Lay, among other companies, used outsourcing of employee hiring to improve efficiency and to reduce costs. From this and other articles, we derived the knowledge that “cost reduction” was an objective and one of the techniques used by PepsiCo to achieve it was through “outsourcing”. In the figure, “reduce costs” is a goal node with a link to “outsourcing”, one of the factors contributing to it. Other factors contributing to cost reduction used by PepsiCo include “forward integration” and “layoffs”. These are also shown as nodes with “C-T” links connecting to the goal node, “reduce costs”.

Various types of questions can be posed to the system concerning management’s goals and strategies, factors contributing to these and the techniques used to accomplish them. We will illustrate these three types of queries using the knowledge structure in Figure 4:

- (1) *What are management’s goals?* To answer this query, the system searches for the goal nodes, identified with darker ovals in the semantic network as follows:
  - improve productivity;
  - increase sales;
  - reduce costs.
- (2) *What are some strategies to improve productivity?* Here the system searches the “productivity” node and identifies factors which contribute to it, by tracing all its “C-T” links. For the PepsiCo case, there are three variables connected to the “productivity” node with “C-T” links:
  - reduce costs;
  - use information technology;
  - improve training.
- (3) *What are some techniques of advertising?* Here the system searches the node “advertising”, and identifies the methods used for it by tracing all its “U-T” links (uses technique/strategy). For the PepsiCo case, these are:
  - use celebrities;
  - support social causes;
  - advertise on major events.

The knowledge base illustrated in Figure 4 is only partial, but can easily be expanded to incorporate other aspects of PepsiCo’s strategy. Practical implementations of IMkIS will be based on in-house corporate knowledge. The key strength of the approach is that assorted knowledge is converted to a usable form using only a limited number of link types. The semantic network is intuitive and can serve as a communication tool between managers and analysts. It lends itself well to the strategic decision-making process by providing knowledge on strategies and goals. Similar knowledge bases can be developed to analyse competitor activities.

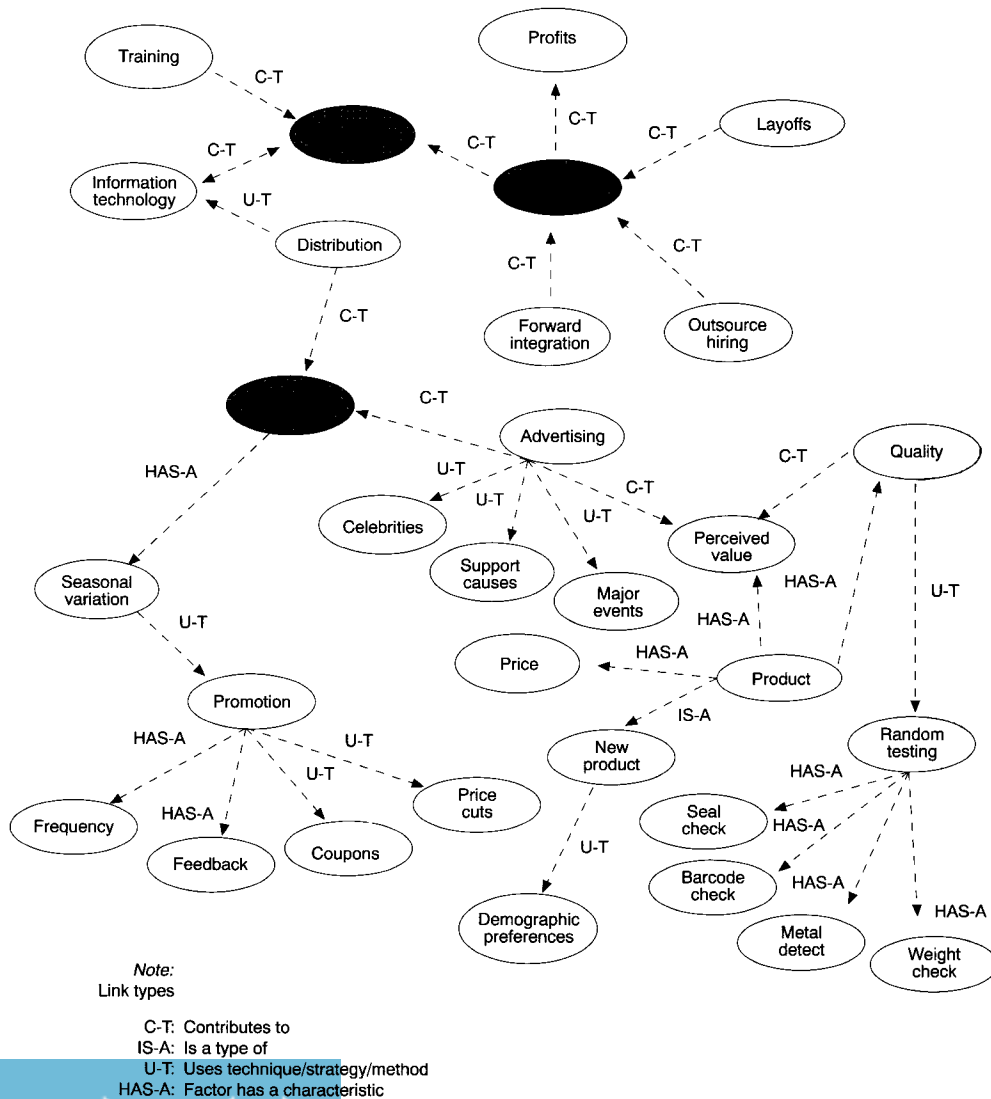
### Implications of intelligent MkIS

IMkIS supersedes conventional MkIS systems. It provides traditional MkIS reporting and library facilities. It can filter information from online databases based on keywords and automatically inform managers about new developments. This increases the relevance of incoming information and reduces information overload to marketing managers. Triggers can be programmed to act when certain trends are detected, for example, if sales fall below a certain level or if a competitor announces a new

product. Threats and opportunities from the environment can be identified in this manner. The system uses traditional MkdSS capabilities to analyse historical sales data from the product database to identify which product is in what phase of product life cycle. The knowledge base distinguishes IMkIS from conventional technologies. It enables marketing managers to incorporate expertise and judgement into the system in a manner that enables it to be freely queried/modified or shared by other managers. Unlike an MkdSS, it can still provide assistance under

environments of partial information. This is frequently the case in marketing because information about competitors, markets, etc. is often not complete. For example, we were able to develop the knowledge structure illustrated in Figure 4 despite not having complete knowledge about PepsiCo. If a marketing system is already in place then the only other component to be developed is the knowledge base. Developing a knowledge base requires skilled analysts and managers who can articulate their strategies. The development and

Figure 4. Knowledge structure



maintenance of the knowledge base must be carefully managed (Greco and Hogue, 1990). System security is a major issue since the knowledge base represents a blueprint of the organization's strategy and could be vulnerable to theft or sabotage. System access must therefore be carefully monitored and controlled.

The advantages of a "well-oiled" (conceptually well-designed) marketing system are numerous. It can provide the firm with competitive advantage while simultaneously reducing costs of manual information collection and information processing. It will be a valuable tool for promoting and sharing organizational learning and assisting in transferring this quickly to other areas of the organization that need it.

### Conclusion

IMkIS has the potential to address some of the pressing concerns facing marketers today. It could help in analysing product features with customer data, evaluating channel and pricing options, creating and testing promotion plans, gaining instant feedback on concepts and plans, and moving marketing plans rapidly into production. The knowledge-base component of the IMkIS enables marketing expertise to be accessed and shared easily. Marketing managers should seriously consider the potential of interfacing artificial intelligence with conventional MkIS in order to have a system that supports their strategic decision making.

**We will eventually  
 move towards a  
 paperless society**

As technologies proliferate, the future of IMkIS will become more exciting. The current push towards the information superhighway and its implementation presents opportunities for direct marketing and impersonal selling. This will help marketers to customize their products and enable them to receive almost immediate online feedback about any product promotion or change in channel effectiveness. A marketing manager can optimize sales presentations and business travel schedules. Virtual reality can be used for sales presentations and customer negotiations. The user-friendliness of voice-activated and handwriting-recognition systems can help marketing managers to interact better with computer systems. With the increasing usage of electronic payments, we will eventually move towards a paperless society in which real-time decisions and actions will be a necessity. It implies greater reliance on IMkIS systems. An organization can be

at a competitive advantage if it responds to, and exploits, these developments.

### References and further reading

- Amaravadi, C.S. and Kumar, N.K. (1994), "Organizational perspectives on EIS design", working paper, Western Illinois University, Macomb, IL.
- Barabba, V.P. (1983), "Steel axes for Stone Age men", *Marketing and the New Information/Communication Technologies*, Harvard Business School 75th Anniversary Colloquium, 26-29 July, Harvard Business School, Boston, MA.
- Barr, A., Cohen, P.R. and Feigenbaum, E.A. (1981), *The Handbook of Artificial Intelligence*, Addison-Wesley, Reading, MA.
- Bench-Capon, T.J.M. (1990), *Knowledge Representation: An Approach to Artificial Intelligence*, Academic Press Limited, San Diego, CA.
- Bessen, J. (1993), "Riding the marketing information wave", *Harvard Business Review*, September/October, pp. 150-60.
- Brien, R.H. and Stafford, J.E. (1968), "Marketing information systems: a new dimension for marketing research", *Journal of Marketing*, Autumn, pp. 19-23.
- Carlyle, R.E. (1988), "Managing information systems at multi-nationals", *Datamation*, March, pp. 54-60.
- Cox, D.F. and Good, R.E. (1967), "How to build a marketing information system", *Harvard Business Review*, Vol. 45 No. 3, pp. 145-54.
- Crissy, W.J.E. and Mossman, F.H. (1977), "Matrix models for marketing planning: an update and expansion", *MSU Business Topics*, Autumn, pp. 17-26.
- Curry, B., Moutinho, L. and Davies, F. (1992), "Constructing a knowledge base for a marketing expert system", *Marketing Intelligence & Planning*, Vol. 10 No. 11, pp. 12-20.
- Dickson, P. R. (1994), *Marketing Management*, The Dryden Press, Orlando, FL.
- Durkin, J. (1994), *Expert Systems: Design and Development*, Macmillan, New York, NY.
- Eisenhart, T. (1990), "Computer-aided marketing: after ten years of marketing decision support systems, where's the payoff?", *Business Marketing*, June, pp. 46-51.
- Evans, K.R. and Schlacter, J.L. (1985), "The role of sales managers and salespeople in marketing information systems", *Journal of Personal Selling and Sales Management*, November, pp. 49-58.
- Francis, B. (1989), "Frito lays a new IS bet", *Datamation*, 15 February, pp. 75-8.
- Greco, A. and Hogue, J. (1990), "Developing marketing decision support systems in consumer goods firms", *Journal of Consumer Marketing*, Winter, pp. 55-64.
- Green, P.E., Goldberg, S.M., Mahajan, V. and Kedia, P.K. (1983), "A decision support system for developing retail promotional strategy", *Journal of Retailing*, Autumn, pp. 116-43.
- Higby, M. and Farah, B. (1991), "The status of marketing information systems, decision support systems and expert systems in the marketing function of US firms", *Journal of Information and Management*, Vol. 20, pp. 29-35.
- Higgins, L.F., McIntyre, S.C. and Raine, C.G. (1991), "Design of global marketing information systems", *Journal of Business and Industrial Marketing*, Summer-Autumn, pp. 49-58.



- Kastiel, D.L. (1987), "Computerized consultants", *Business Marketing*, March, pp. 52-74.
- Kirsh, D. (1992), *Foundations of Artificial Intelligence*, MIT Press, Cambridge, MA.
- Kotler, P. (1988), *Marketing Management: Planning, Analysis and Control*, Prentice-Hall, Englewood Cliffs, NJ.
- Levitt, T. (1983), *The Marketing Imagination*, The Free Press, New York, NY.
- Lillis, C.M. and McIvor, B.J. (1984), "MDSSs at General Electric: implications for the 1990s from experience in the 1970s and 1980s", *Marketing and the New Information/Communications Technologies*, Harvard Business School Colloquium, 26-29 July, Boston, MA.
- Little, J.D.C. (1984), "Decision support for marketing managers", *Journal of Marketing*, Summer, pp. 9-27.
- McKenna, R. (1991), "Marketing is everything," *Harvard Business Review*, January-February, pp. 65-79.
- McLeod, R. (1990), *Information Systems*, Macmillan Publishing Company, New York, NY.
- McLeod, R. and Rogers, J. (1985), "Marketing information systems – current status in *Fortune* 1,000 companies", *Journal of Management Information Systems*, Spring, pp. 57-75.
- Malone, T.W., Grant, K.R., Brobst, S.A. and Cohen, M.D. (1987), "Intelligent information-sharing systems", *Communications of the ACM*, May, pp. 390-402.
- Proctor, R.A. (1991), "Marketing information systems", *Management Decision*, Vol. 29 No. 4, pp. 55-60.
- Proctor, R.A. (1992), "Marketing decision support systems: a role for neural networking", *Marketing Intelligence & Planning*, Vol. 10 No. 1, pp. 21-6.
- Ram, S. and Ram, S. (1989), "Expert systems: an emerging technology for selecting new product winners", *Journal of Production and Innovative Management*, Vol. 6, pp. 89-98.
- Rockart, J. and Morton, S.W. (1984), "Implications of changes in information technology for corporate strategy", *Interfaces*, January-February, pp. 84-95.
- Schmidt, D. (1993), "Automated production planning: a new solution to the old problem of promotion cost-effectiveness", *Journal of Advertising Research*, July-August, pp. RC4-8.
- Schwoerer, J. and Frappa, J. (1986), "Artificial intelligence and expert systems: an application for marketing and marketing research", *European Research*, Vol. 14 No. 4, pp. 510-24.
- Thompson, A.A. and Strickland, A.J. (1993), *Strategic Management: Concepts & Cases*, R. D. Irwin, Homewood, IL.
- the warehouse area (*Modern Materials Handling*, January 1987, pp. 78-81).
- (2) Frito-Lay conducts a pre-audit and freight payment programme to ensure that only legitimate costs are paid and duplicate billings are eliminated (*Distribution*, December 1987, pp. 20-26).
  - (3) Frito-Lay's Doritos uses talk-show host, Jay Leno, in its national television advertising campaign "Doritos taste as good as its crunch" (*Dallas-Fort Worth Business Journal*, 15 February 1988).
  - (4) Frito-Lay's Crunch Tators is a response to Zapp's Potato Chips in New Orleans. Its marketing plan includes radio and television advertising, billboards, special event tie-ins and in-store sampling and promotions in conjunction with the French Quarter Festival in New Orleans (*The Greater Baton Rouge Business Report*, April 1988).
  - (5) Frito-Lay has put computers in the hands of its 10,000 salespeople to close the loop on transaction processing in its efforts towards a decision support system. This has resulted in a productivity boost. The Fujitsu computer comes equipped with 256KB of memory, a printer (attached to the salesperson's van) and a modem (*CIO*, June 1988, pp. 38-44).
  - (6) Frito-Lay's Doritos links its chips with the advertising campaign against drugs since its principal customers are families with teenagers. Doritos gives a penny to the "Just Say No Foundation" for every bag bought during a particular time period (*The Washington Post*, 2 September 1988).
  - (7) Frito-Lay uses Cadec's on-board computers on its distribution trucks to monitor speed, hours worked and miles driven per day, and the number of stops made (*Distribution*, February 1989, pp. 48-55).
  - (8) Frito-Lay is the only major company to test the idea of advertising on the floors of grocery stores by promoting product combinations (*The Business Journal-Portland*, 22 May 1989).
  - (9) Frito's huge research and development resources open up a broad range of opportunities to introduce the kind of products that could fit with the concept and brand of its acquisitions like Smart Foods Inc. (*Boston Business*, June 1989).
  - (10) Since 1988, owing to its decision support system, Frito-Lay has added 400 routes without increasing its sales-force and has pushed revenues up by almost \$1 billion (*Fortune*, 24 September 1990).
  - (11) PepsiCo has begun to measure success against global profits not bragging market rights. Friedman cited several Frito-Lay snack foods as big winners among new products in the 1980s (*Dallas Times Herald*, 9 January 1991).
  - (12) Frito-Lay Inc. won the Third Annual Computer World Smithsonian Award for business and related services. It was selected for its technological innovations, meeting goals of targeted niches and positive impact on society (*Computerworld*, 17 June 1991, pp. 89-91).

#### Appendix: strategic notes for the PepsiCo case

In chronological order of reporting:

- (1) Frito-Lay's warehousing and distribution operations have automated control and tracking of inventory to provide timely shipments and fresh products. They provide gentle handling to reduce breakage and flexibility to ensure continued good service to sales. They use an automated storage and retrieval system to track all materials in and out of storage. The "system activity monitor program" monitors the location of all materials and activities of all automated equipments in

- (13) Frito-Lay has a 41 per cent share in the \$10 billion retail domestic snack market. Recently, its competitors such as Borden, Anheuser-Busch and Keebler Co. have come up with price-cutting moves. Analysts say that Frito-Lay used discounting to remain competitive. It used layoffs to become a leaner organization, and redirected expenses to build market share and protect profits. Currently for every dollar invested in Frito-Lay, the company got 25 cents in return (*Dallas Times Herald*, 17 September 1991).
- (14) Frito-Lay has an elaborate data communications network called "very small aperture network" that links 220 distribution centres to sales offices and manufacturing plants. Sales people upload route-accounting information to their computers. This information is forwarded to the satellite network hub. The computers also help salespeople receive updates on product pricing, sales promotions and corporate news. This has helped in facilitating a quick communications environment (*Networking Management*, November 1991, pp. 90, 92).
- (15) During 1991, Frito-Lay had successfully introduced new products, reformulations and marketing campaigns aimed at invigorating existing product lines (*Supermarket Business*, September 1992, pp. 134-5, 164).
- (16) A corporate reorganization in late 1991 challenged Frito-Lay's workforce to be more involved in day-to-day decision making as well as the long-term strategic planning. Continuous training has become a way of life at Frito-Lay. The company historically transfers its managers every two to four years (*Daily Record-Wooster*, 29 January 1993).
- (17) Hostess Frito-Lay has distribution centres in every Canadian province. Frito-Lay owns its own distribution routes throughout USA and Canada (*Toronto Star*, 2 February 1993).
- (18) Frito-Lay is combining its supermarket marketing expertise and distribution power of Frito-Lay with the dominant brand name and product quality of Taco Bell to deliver Mexican foods to supermarkets. The marketing plan will be supported by Frito-Lay with PoS materials, couponing, in-store displays and in-store sampling (*Newswire*, 8 February 1993).
- (19) Frito-Lay's campaign for its reformulated Lay's potato chips was successful, partly because of Super Bowl exposure (*Adweek*, 10 May 1993, pp. 34-41).
- (20) Frito-Lay successfully uses outsourcing of human resource professionals (*Personnel Journal*, September 1993, pp. 92-101).
- (22) PepsiCo operates 22,000 restaurants and has about the same number of sales routes in snacks and soft drinks. All of these units are entrepreneurial in nature with greater autonomy and significant authority and responsibility for local managers (*PR Newswire*, 23 September 1993).
- (23) PepsiCo intends to branch into similar consumer products that use the same type of distribution systems and the same type of marketing techniques. This helps in growing the business faster than the brands (*New Orleans City Business*, 18 October 1993).

---

Chandra S. Amaravadi is an Associate Professor, Subhashish Samaddar is State Farm Professor of Information Management at the Department of Management Information Resources in the College of Business and Siddhartha Dutta is a Graduate; all are at the Western Illinois University, Macomb, Illinois, USA.

---