CHAPTER 1

RETAIL MARKETING AND EXPERT AND DECISION SUPPORT SYSTEMS
INTRODUCTION

Many definitions exist with differing emphasis on the process of marketing, the functional activities that constitute marketing and orientation (philosophy). Drucker's definition of marketing orientation is "Marketing is so basic that it cannot be considered a separate function on par with others such as manufacturing or personnel. It is first a central dimension of the entire business. It is the whole business seen from the point of view of its final result that is from the customer's point of view".

A significant shift in emphasis since Drucker wrote this is to be found in the importance that is now attached to competitive position in a changing world. Thus the marketing concept is that managerial orientation which recognises that success primarily depends upon identifying changing customer wants and developing products and services which match these better than those of competitors. The contrasting emphases on customers and competitors is that the self-centered category is characterised by an introspective orientation that focuses on year-on-year improvements in operating ratios in sales volume without making direct comparisons with competitors. Such an orientation is potentially dangerous when viewed in strategic terms. At the opposite extreme is a market driven approach to marketing which seeks to balance a responsiveness to customers' requirements on the one hand with direct competitors comparisons on the other.

Most managements keep up-to-date with the complex and changing market place by commissioning research, visiting customers and distribution outlets, discussing with their sales forces, and even talking to the competitors. This can give the appearance of detailed knowledge of the markets on which operating decisions can be taken; the reality is sadly often very different. In practice research data is so much that management can not find time to analyze and digest its depth. When the research findings conflict with the conventional wisdom in the company, the validity of research is often questioned rather than the subjective opinions of the marketing/ sales team.

Furthermore, unless sales force, trade, customer and competitor opinions are collected and analysed very carefully, they can be misleading. Many marketing staff seem to confuse knowing the market well with what in practice is often the case: knowing that part of the market they happen to be servicing at the moment. It is often forgotten too that sales force views are usually based on their buyers' interpretation of what they think is happening in the market place and then sometimes further biased by the negotiating relationship between them.

DECISION MAKING IN MARKETING

The process of decision making is rendered problematic on account of the existence of risk and uncertainty. In the face of risk or uncertainty some managers postpone making a choice between alternative courses of action for fear of that choice being wrong. What they typically fail to recognise in this situation is that they are
actually making another choice - they are deciding not to decide.\textsuperscript{2} which favours the status quo rather than change. This is not a mean of eliminating risk or uncertainty since it seeks to ignore them rather than to accommodate them. If the central question in the management process concerns the need to make decisions, we need to know what decisions should be made and how they should be made.

The managers responsible for core competencies must endeavour to continuously produce new knowledge within the company or gain it from outside. This knowledge has to be grouped together and translated into core competencies. Here the construction of basic organizational knowledge accessible to all company members is vital. The danger of market research lies in companies becoming almost slaves to statistics. What matters is only to meet the articulated needs. What happens is confusion of quality and quantity. Companies can only recognise qualitative change and benefit from it if they focus on core competencies. With such an approach one can overcome buyers' bias and can increase their value by satisfying customers faster and better than customers expected that they would. Summarising, "the customer is not the "measure of all things". Neither is the one and only arbitrator in competition".\textsuperscript{3}

The aim of marketing theory has been stated in broad terms as being "...... to comprehend what is known and to derive a set of principles or action guides to enable businessmen to manage their affairs better.\textsuperscript{4} It follows therefore that if theory is


concerned with knowing, those who dismiss it are recommending a policy of not knowing, the practical individual operating with out a theoretical knowledge is the individual who does not really know what he is doing. This is not to say of course, that practice is not vitally important. It is but theory and practice are two sides of the same coin and emphasising one or merely neglecting the other is potentially dangerous if one fails to appreciate that sound practice must rest on valid theories and valid theories must facilitate sound practice.5

Scientific theories in marketing enable us to explain and understand the behaviour of marketing variables and their interrelationships. The emphasis will usually be on causal relations, but one should not expect set of precise cause and effect rules to emerge that are applicable under any set of circumstances. In the management field it is never possible to say: "If I do A and B, the C will inevitably happen". The best that the decision maker in most situations can say is :" If I do A and B, the result is most likely to be C. And if I neglect to do A and B, it is very probable that the consequence will be unfortunate.

When the marketing analyst has a validated predictive theory of cause and effect relationships among phenomena of interest to him, he is able to control the effect by exerting the pressure on the causes. Since effects lead to the attainment of objectives this makes the achievements of purpose possible. Available marketing theories are not yet comprehensive, but appreciating the role of theories and having some awareness of

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theory construction are essential qualities for the good decision maker. In considering
the relationship between sales calls and sales or that between the speed of delivery (or
level of service) and sales, a marketing manager might assume that at some stage
diminishing returns set in (i.e. no matter how many sales calls are made, or how rapid
delivery is or how many orders can be filled immediately ex-stock, the level of sales will
not increase to infinity). It is up to the manager to develop a theory of how and at what
rate sales vary in response to changes in other variables. An approach such as this clearly
has major implications regarding the provision of data but it also demands the formal
consideration of how a particular courses of action lead to particular outcomes and thus
requires an analytical framework for improving decision making performance. By
contrast the use of practical experience alone as a basis for decisions is tantamount to
uncontrolled experimentation with no formal explanatory foundation thereby rendering it
a faulty guide to the prediction of future events and totally inadequate basis for control.
We can characterise the main features of theories that support practice through simple
models. 

We can define model as a simplified representation of some part of
reality. If it were not a simplification of reality it would be both too complex to use and
also redundant (since there is no point in replication of reality). Relevance will determine
the features that are to be modeled in relation to a formulated problem. The popularity of
models in recent years is due to an improved competence on the part of the decision

\[6\] Malcolm H. B. McDonald & Peter Morris, the Marketing Plan, 1993, A Pictorial Guide for Managers.
Butterworth Heinemann Ltd.
maker to build and use them (often in conjunction with the computing facility), a greater need to incorporate rapidly increasing uncertainty of problem situation in the decision making process and the utility of models in carrying out experiments (simulation) which could not be performed in reality.

Models are important for effective decision making. However many models suffer from rigour without relevance in that they are highly refined and elegant in mathematical terms but fail to reflect the key features of marketing problems and processes. It is important to see that marketing models are not ends in themselves but simply means to an end - the making of better marketing decisions rather than the unlimited postulation of irrelevant truths.

By thinking in terms of purposive systems one gets away from the descriptive view of marketing consisting of a number of separate departments carrying out a range of separable activities. The coherence of its elements distinguishes a system from the jumble of items that might otherwise be perceived and this simply reflects the real world. In summary, then, by using systems models as a means of studying marketing processes and problems we are focusing attention on certain key questions, namely:

1. What purposes are to be served by the system? (In other words, what objective is to be satisfied by the solution to the marketing problem represented by the system model?)

2. What structure (or organization) should exist among the variables within the system in order that the desired behaviour patterns might emerge?

3. What inputs are required to achieve the system's purpose?

4. What outputs are required and how should these be measured?

5. What constraints exist to limit the system's ability to behave in the desired manner?

6. With what degree of efficiency and effectiveness is the system operating?

Any model is a simplified representation of larger, more complex slice of reality. In order to make modeling useful in decision making the most general approach has been to inquire about the effects (outcomes) that result from changing the inputs (causes) to the model on "What if...? basis. This is one feature of experimentation (in the form simulation) which can also be applied by restructuring the model itself.

MARKETING AUDIT

A complete marketing audit should be a starting point for the strategic marketing planning process. The thinking that underpins the concept of marketing audit is straightforward, it is that corporate objectives and strategy can only be developed effectively against the background of a detailed and objective understanding both of corporate capability and environmental opportunity. The audit is therefore as Mc.donald (1984 p.14) has suggested "The means by which a company can identify its own strengths and weaknesses as they relate to external opportunities and threats. It is thus a
way of helping management to select a position in that environment based on known factors.  

The audit is a systematic, critical and impartial review and appraisal of the total marketing operation: of the basic objectives and policies and the assumptions which underlie them as well as the methods, procedures, personnel and organizations employed to implement the policies and achieve the objectives.9

Kotler's view is broadly similar. A marketing audit is a comprehensive, systematic independent and periodic examination of a company's or business units marketing environment, objectives, strategies and activities with a view to determining the problem areas and opportunities and recommending a plan of action to improve the company's performance.10

Assessing the changing environment in which the company operates can be complex enough, but at least it can usually be done with some objectivity. The marketing audit is designed to assess the competitive effectiveness of the marketing activities of the company, identify strengths and weaknesses in the operation and report the findings to top management. This should furnish an objective basis for future planning. In an increasingly complex, international and changing world, it is difficult for

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senior management to know how effective the marketing organization is without some form of regular monitoring. The marketing audit should look at the competitive effectiveness of the current activities as well as at results, thus establishing a basis for predicting the likely outcome. A thorough audit can take more time than is normally available over and above everyday commitments. External consultants will not only have the time and the objectivity but also should possess a broader expertise based on best current practice in other analogous companies or industries which can bring a further dimension to the evaluation process.

An information audit should also take place concurrently to build effective systems. An information audit is a systematic examination of information use, resources and flows with verification by reference to both people and existing documents in order to establish and monitor the extent to which they are contributing to an organization's objective. Such an audit should include a mixture of professional techniques such as observation, inquiry quantification, benchmarking, assessment, checking and evaluation. This process will help information worker to learn how information is managed at present and how they might manage it better in the future.11

Physical stocktake, information mapping and information needs analysis are also important for building effective system solution. Physical stocktake represents a process through which information resources are identifies and categorised in a


systematic way. It is effectively a snapshot of what exists within an organization in terms of information resources at a given time. It can be applied at an organizational level, a departmental level or even a personal level.\(^{12}\)

Information map provides a powerful means of illustrating exactly where critical information resources are positioned (geographically, departmentally, technically), how they interact, who uses them and who is responsible for them.\(^{13}\)

Working from the overall viewpoint of an organization and taking into account the operational or functional objectives of that organization, information needs analysis sets out to determine what information staff members actually need to fulfill their roles and achieve their goals.

An competitive intelligence system is also of paramount importance for an organization. In establishing such a system, there are five principal steps.

1. Setting up the system and deciding what information is needed.
2. Collecting the data.
3. Analysing and evaluating the data.
4. Determining the conclusions.
5. Incorporating these conclusions into subsequent strategy and feeding back the results so that the information system can be developed further.


\(^{13}\) Keen J.S. Managing System Development, New York: John Wiley & Sons, 1981
The mechanisms of an effective Competitive Information system are straightforward as Davidson (1987, p.134) has pointed out (1) Select key competitors to evaluate. Focus on three or four per market at most. (2) Select and brief data collectors in each department. This should include people in Sales, Purchasing, Engineering, Marketing, R & D and Finance. (3) Apply the right resource levels to task. It is usually worthwhile having at least a part-time competitive analyst to chase, coordinate and evaluate competitive data. (6) Insist on regular returns from data collectors. (7) Publish regular tactical and strategic reports on completion. The tactical ones could be fortnightly and widely circulated. The strategic ones could be less frequent perhaps quarterly and go to senior management only.14

The sources of data are likely to vary significantly from one industry to another. A useful framework for data collection can be developed by categorising the information.

However, managers in Sales and Marketing take a very different approach to information than does a systems analyst who has traditionally been involved in developing the systems they use. Managers need to handle data in a flexible way, their needs in this respect develop in response to events as they happen. Many managers seem to be successful without recourse to formally provided information. There is a fundamental issue here which has been largely ignored by the researchers. Surveys

indicate that many managers are using information but why do managers show a marked preference for their own sources of information rather than formal corporate systems. User needs surveys are not just sufficient. We need to investigate the manager and his/her information collecting habits at a more fundamental level and make appropriate changes to our own systems. Differing type of tasks the managers undertake in their organization need to be thoroughly looked at. Information for control tasks often takes the form of benchmarking or comparison of current data with that for the previous periods which is provided from internal sources. During the strategic planning process, it is not always obvious what questions need to be asked let alone what information will be needed. Managers also need a mechanism by which usefulness of the data can be determined. Where does the manager find such a mechanism? If the information is quantitative then formal modeling systems may help, but frequently the information is qualitative and thus may be more difficult to use in decision making or problem solving. To solve the problem, manager very reasonably turns to someone else (subordinate, a peer, contact etc.) with whom to discuss the information in an attempt to form some consensus about the usefulness of it. The discussion with others has many advantages - feedback is instantaneous, misconceptions can be corrected, points clarified and additional information provided, further information may even be picked up from the body language.

Managers have regular meetings with subordinates and superiors during which they collect information- they sit on committees, meet peers, customers etc. and so are well placed to collect information on the external environment. These meeting also
afford them an opportunity to collect another type of information - trigger information. This is the information about the potential business/opportunity that triggers an activity. This trigger information frequently take the form of hearsay and gossip and managers show a marked preference for this kind of information.  

RETAIL MARKETING

Retailing is a significant field of study. Retailing is derived from the old French word retailer, which means "to cut up". "Retailing includes all the activities involved in selling goods or services directly to final consumers for their personal, non-business use."  

"Retailing is not an area of hope", "it's not fun. It's almost a war." And the causalities are almost certain to keep mounting. By the end of the 90's,... half of the nation's current retailers will be out of business....The companies that succeed will be the ones that avoid crippling debt, focus tightly on specific customers or products, and hook into technology to hold down costs and enhance service. A tough act."  

Retailers using a value positioning prospered. Consequently, value has become a key retailing buzzword for this decade. Although value is not a new concept, 

its meaning has changed. No longer does it mean offering the low priced goods. Instead, it means offering the right styles and quality at the right price for the target customer.

Retailing may be studied by using an institutional approach, a functional approach and a strategic approach. The strategic approach needs a greater focus as the underlying principle in this approach is that retail firm needs to plan for and needs to adopt to a complex changing environment.

A retail strategy is overall plan or framework of action that guides a firm. It contains a situation analysis, objectives, the identification of a customer market, a broad strategy, specific activities, control and feedback.

Situation analysis is the objective evaluation of the opportunities and potential problems facing a retailer. It seeks to determine a retailer's current position and where it should be heading. This analysis consists of defining and adhering to a philosophy of business, evaluating ownership and management alternatives, and outlining the goods / services category to be sold. A philosophy of business is a long term commitment to a type of business and a place in the market.

A company may be interested in one or more of the objectives: Sales (growth, stability and market share), profit (level, return on investment and efficiency), satisfaction of publics (stock holders, consumers and others) and image (customer and industry perception). Next, consumer characteristics and needs are determined and a retailer selects a target market. A retailer can sell a broad spectrum of consumers (the
mass market); zero in on one customer group (a market segment); or aim at two or more
distinct groups of consumers (multiple segments) with separate retailing approaches for
each. Then a broad retail strategy is formed. This strategy involves controllable variables
(those aspects of business that the retailer can directly affect) and uncontrollable
variables (those factors that the retailer cannot control and to which it must adapt). The
major controllable variables are store location and operations, merchandising, pricing and
store image and promotion. The key uncontrollable variables are consumers,
competition, technology, economic conditions, seasonality and legal restrictions. All of
these elements must be coordinated and taken into consideration in order to have
consistent, integrated, unified strategy.

A retail strategy mix is the combination of store location, operating
procedures, goods/services offered, pricing tactics and promotion methods. In order to
properly develop and apply a strategy a retailer must identify and understand its
customers. This involves determining which type of target market to reach, identifying
the characteristics and needs of the chosen target market and understand how consumers
make decisions.

Consumer characteristics and needs can be identified by studying
demographic and life-style factors. Demographics are easily identifiable and measurable
population statistics; life styles are the ways in which consumers live and spend time and
money. Consumers can be described in terms of these demographic factors: population
size, number of households, place of residence, mobility, gender, employment status.
Consumer life-styles are comprised of social and psychological elements and are greatly affected by demographics. Social factors include culture, social class, reference groups, performance, the family life cycle and utilization. Psychological factors include personality, class consciousness, attitudes, perceived risk and the importance of the purchase. As with demographics, a retailer can generate a lifestyle profile of its target market by analyzing these concepts.

When a retailer gears its strategy toward satisfying consumer needs, the retailer is appealing to their motives- the reasons for their behaviour. The better a company addresses the needs of its consumers, the more likely they are to make a purchase. Retailers also require some knowledge of consumer behaviour, the process whereby individuals decide whether, what, when, where, how and from whom to purchase goods and services. The consumer decision process has six basic steps: stimulus, problem awareness, information search, evaluation of alternatives, purchase and post-purchase behaviour. The process is influenced by a person's background and traits.

A stimulus may be a social or commercial cue or physical drive meant to motivate a person to act. At problem awareness, the consumer not only has been aroused by stimulus but further recognises that the good or service under consideration may solve a problem of shortage or unfulfilled desire. Next, an information search
determines the available alternatives and the characteristics of each. Then alternatives are
evaluated and ranked. During the purchase act, a consumer considers the place of
purchase, the terms and availability. After a purchase is made, there may be a post-
purchase behaviour in the form of additional purchases or reevaluation. The consumer
may have cognitive dissonance if there is doubt that the correct decision has been made.

Every time a consumer makes a purchase, he or she uses a form of the
decision process. However the process may be used subconsciously and it is affected by
the consumer’s characteristics. Extended decision making occurs when a person makes
full of the six steps in the decision process. In limited decision making, each of the steps
in the process is used but not in great depth. Routine decision making takes place when
a person buys out of habit and skips steps in the purchase process. Retail research
findings provide insights into various aspects of consumer demographics, life-styles, and
decision making, such as shopper profiles, impulse purchases and store loyalty.

Whether developing a new retail strategy or modifying an existing one,
accurate information is necessary. And the use of sound marketing research techniques
enables a retailer to generate the proper information. Marketing research in retailing
consists of a series of activities: defining the problem to be researched, examining the
secondary data, gathering the primary data, analysing the data, making recommendations
and implementing findings. It is not a single act.

Retailers often have a key role in collecting primary data because of their
position at the final stage in a distribution channel. Retailers can provide informal
feedback to suppliers, allow data to be gathered on their premises, assist suppliers in monitoring consumer behaviour, pass along information on consumer characteristics and participate in single source data collection. Obtaining useful information should be viewed as an ongoing, well-integrated process. A retail information system anticipates the information needs of retail managers; continuously collects, organizes and stores relevant data and directs the flow of information to the proper retail decision makers.

The choice of a store location is important because of the complex decision making involved, the high costs, the lack of flexibility once a site is chosen and the impact of a site on retailer's strategy. A good location may enable a retailer to succeed even if its strategy mix is relatively mediocre.

The selection of a store location consists of four steps: 1. Evaluating alternative trading areas. 2. Determining the most desirable type of location. 3. Picking a general site and 4 settling on specific site. A trading area is a geographic area from which a store draws its customers. Each such area has primary, secondary and fringe components; the further the consumers live from a shopping area, the less likely they are to travel there. The size and shape of a trading area depend on store type, store size, the location of competitors, travel time and traffic barriers and media availability. The size, shape and characteristics of the trading area for existing store or a group of stores can be delineated quite accurately. A retailer can gather data by examining store records, sponsoring contests, recording license plate numbers and linking them to customer
addresses and surveying consumers. Time biases must be considered when amassing
data. Results should be mapped and customer densities noted.

Alternative trading areas for a new store must often be described in terms
of market opportunities rather than current traffic patterns. Trend analysis and consumer
surveys may be employed. Two quantitative methods for defining trading-area size are
Reilly's law of retail gravitation, which relates the population size of different cities to
the size of their trading areas; and Huff's law of shopper attraction which is based on
each area's shopping assortment, the distance of consumers from various retail locales
and sensitivity of people to travel time.

After the size and shape of each trading area has been determined, its
characteristics should be studied in depth. These characteristics include population size
and features, availability of labour, closeness to supply, promotion facilities, economic
base, competition, availability of locations and regulations.

A trading area may be understored, overstored or saturated. Store
saturation may be measured in several ways, such as the number of persons per retail
establishment, the average sales per retail store, the store sales per capita or household
and the sales per square foot of selling space. One general ratio is the index of retail
saturation, which is based on the number of customers, their retail expenditures and the
square footage available for a given good/service category in each trading area.

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William J. Reilly, Method for the study of Retail Locations (New York: F.W. Dodge, 1959), p149

After a retailer assesses alternative trading areas, it determines what type of location is desirable, selects the general location and chooses a particular store site. There are three basic types of locations that a retailer should distinguish among: the isolated store, the unplanned business district and the planned shopping center.

There are many specific aspects of operations management, each requiring complex and ongoing decisions and implementation by the retailer. Store format, size and space allocation considerations include the use of prototype stores, the size of stores and the allocation of space in the stores. Through inventory management, a retailer seeks to acquire and maintain a proper assortment of merchandise while keeping ordering, shipping, handling and other related costs in rein. Just-in-time inventory planning, which relies on frequent and small orders is growing in usage.

Christopher defined customer service as a system organised to provide a continuing link between the time that the order is placed and the goods are received with the objective of satisfying the customer needs on a long term basis.20

A broader perspective of customer service is afforded by Blenel and Bender who suggest three missions.

1. The first mission of service is to protect the company's customer base.

2. Services second mission is to enhance the product's salability.

3. The third mission of service from the marketing perspective is to generate income.21

La Londe and Zinszer and other commentators have suggested a number of common elements of customer service from a distributor view point.

1. Speed of response (time taken to deliver from receipt of order).
2. Consistency and reliability of delivery.
3. Order size constraints.
4. Convenience of ordering system (Customer friendliness).
5. Flexibility of delivery times.
6. Invoicing procedures and reliability.
7. Claims and Complaints procedures.
8. Order Status Information system.
9. Condition of goods on delivery.²²

There are two major aspects to the process of order fulfillment namely the choice of intermediaries between manufacturer and user and the management of physical distribution including stocking and transportation. Both these aspects involve decision of crucial nature since can make or mar long term relationships through the level of customer service that they afford. The level of distribution costs need to be taken into consideration along with other factors while making choice out of the exclusive, selective or intensive modes of distribution. The decision will depend to a large extent on the nature of the product, the target market segment and the product positioning.

Lancaster and Massingham suggest that some of the factors which would persuade a company towards a more exclusive form of distribution would include:

1. Where the customer needs or expects specialist service, advice, facilities or service.
2. Where the manufacturer and/or distributor would gain from the enhanced image associated with selective/exclusive distribution.
3. Where potential sales volume would not warrant more intensive distribution.
4. Where the manufacturer wishes to exercise more control over channel members marketing activities.
5. Where more intensive distribution might result in conflicts between channel members.23

It is only in recent years that Distribution and the wider business philosophy of logistics have come to receive serious attention from both the business and academic worlds. One very obvious reason for this neglect is that while the function that comprise the logistics is integrative activity in business has developed only recently.

Bowersox defines "logistics" as "the process of strategically managing the movement and storage of materials, parts and finished inventory from suppliers through the firm and on to customers.24

Logistics is thus concerned with the management of the physical flow which begins with the sources of supply and ends at the point of consumption. It is clearly therefore much wider in its reach than simply a concern with the movement of goods - a commonly held view of physical distribution. In the logistics scheme of things we are as much concerned with the plant and depot location, inventory levels, materials management and information system as we are with transport.

One of the features of the logistics concept - which is its greatest attraction which simultaneously being the greatest obstacle to its widespread adoption in industry so far - is that it places the emphasis on integrating activities that traditionally have been located in different functions of the business. Thus in many companies, responsibility for, say inventory on the one hand and transport on the other may be vested in the production function and the distribution functions respectively and decisions on one will often be made without regard for the other. The logistics viewpoint, however, forces the decision makers to recognise the connections between the component elements of the materials flow system - indeed it encourages comprehensive systems thinking rather than functional tunnel vision.

It is interesting to trace the evolution of thought in the logistics activity and then to assess its importance for business today.

As early as 1915, writing from Harvard Business School, Arch Shah took a view of the logistics activity which was radically farsighted.
"The relations between the activities of demand creation and physical supply....illustrate the existence of two principles of interdependence and balance. Failure to coordinate any one of these activities with its group fellows and also with those in the other group or undue emphasis or outlay put up on any one of these activities, is certain to upset the equilibrium of forces which means efficient distribution". 25

The view of logistics as a bridge between demand creation and physical supply is as valid today as it was when first expressed 83 years ago. However, no matter how fundamental this idea was, very little attention seems to have been paid to it and one of the gurus of management Peter Drucker, stated that

"Physical distribution is today's frontier in business. It is one area where managerial results of great magnitude can be achieved. And it still largely unexplored territory".26

There are signs, however that management consciousness of the importance of logistics is growing and the last ten years have seen a considerable upsurge in interest in this area and in the integrated systems as evidenced from the number of organizations going for Packaged software called the ERP solutions. An Enterprise Resource Planning solution is an off-the-shelf integrated information system. Process design plays a pivotal role in an ERP solution.


Changes in information technology make it possible to provide decision makers with a great deal of relevant information which should be beneficial. The benefits of investment in information technology have been enthusiastically proclaimed over the last decade and are said to range from increasing internal efficiency to facilitating inter-organizational communication and enabling new forms of product or service delivery. Indeed it may be that the effective and timely adoption of Information Technology is a prerequisite for competitiveness, with IT facilitating differentiation in, for example, customer service or product quality, as well as potentially leading to increased productivity and lower costs.

Yet the implementation of IT in organizations is by no means as straightforward and unproblematic as is sometimes assumed and there may be limits to its capabilities.

It is the issue of IT effectiveness, the need for Expert/Decision support Systems, the areas of application where they are required and are feasible to be built which this study aims to explore by looking specifically at the application of information technology/Artificial intelligence to marketing. The study is the latest and first research into the use of IT and the AI by the Marketing function in an oil company. Marketing has not by any means been immune from the apparently revolutionary impact of IT, judging by the volume of enthusiastic book and articles on the subject and ever increasing number of packaged software products aimed at sales and marketing managers.
Organizational spending on IT appears to be increasing. This increase can be attributed to the success of the packaged software in the form of Enterprise Resource Planning. The issue arises as to whether the use of IT in marketing is significantly different in any way from the use of IT in other functional areas of the business and whether or not there are unique questions posed. Holthman suggests that there are and distinguishes the use of IT for marketing purposes from its use in other organizational applications, stating that IT in marketing is not simply another type of functional information system like accounting and personnel which are ultimately focused on the internal administration of the organization. Many elements of Marketing states Holthman, are also internally focused but many deal with the interface between the organization and its customers, leading different types of IT use, such as databases which must instantly accessible in the event of a customer inquiry or even to IT systems which are accessed by customers themselves. Such an external focus might also extend to the apparently increased focus of the marketing function on managing relationships with wider networks of individuals and organizations such as suppliers and resellers with the result that IT systems need to be compatible not just within a single organization but between organizations too.

Others have suggested that marketing activities involve a high degree of creativity and that it is for this reason that the marketing function was apparently relatively slow to adopt IT systems in the past. Rashi Glazer for example states that "...
the creative nature of marketing will always show up computers' limitations .... the problem with computers is that they do not inherently provide you with speculation."27

An Information System can be considered as marketing-oriented in so far as its usage can mirror the Marketing Activity of the firm, and when it can contribute to this very Marketing activity too. IT end users are no longer satisfied with Information Systems which are aimed at relieving them from tedious and repetitive tasks, but they demand that new technologies actually bring added value to their Marketing activity and results. It is therefore necessary that the Marketing Oriented Information System be placed within its Marketing Context, right at the beginning of the design process.

The areas in which IT can be applied to marketing activities are considerable and varied. However, the application of IT to marketing is not without its potential difficulties. Shah concluded that not only were majority of the marketing professionals dissatisfied with their IT systems, but that dissatisfaction mounts as the complexity of the applications increases from personal productivity tool to more sophisticated marketing information systems,28 Decision Support System and Expert Systems.


Expert/ Decision Support Systems

The British Computer Society defines an expert system as "The embodiment within a computer of knowledge-based component, from an expert skill, in such a form that the system can offer intelligent advice or take an intelligent decision about a processing function. A desirable additional characteristic, which many would consider fundamental, is the capability of the system, on demand to justify its own line of reasoning in a manner directly attributable to the inquirer. The style adopted to attain these characteristics is rule based programming".29

Knowledge Based systems are the systems which have factual ,procedural and little or no expert knowledge for a given task or problem domain. Knowledge is represented primarily in the form of rules. Has an inference mechanism. Knowledgebase may be relatively static and need little or no maintenance or for some domains may need frequent updates.30

An expert system is a computer application that solves complicated problems that would otherwise require extensive human expertise. To do so it simulates the human reasoning process by applying specific knowledge and inferences. An ideal expert system can be characterised as including the following:

* Extensive specific knowledge from the domain of interest.


The goal of Artificial intelligence scientists had always been to develop computer programs that could in some way think, that is solve problems in a way that would be considered intelligent, if done by human. In the sixties, Artificial Intelligence scientists tried to simulate the complicated process of thinking by finding general methods for solving broad classes of problems; they used these methods in general purpose programs. Despite some interesting progress, this strategy produced no breakthroughs. The more classes of problems a single program could handle, the more poorly it seemed to do on any individual problem. They then realized that it was too difficult to make the entire program general purpose, they would concentrate in stead on developing general methods or techniques to use in a more specialized programs. So during the seventies they concentrated on techniques like representation- how to formulate the problem so it would be easy to solve- and search- how to cleverly control the search for solution so it would not take too long a time. Again the strategy produced some successes but no breakthroughs. In the late 1970s AI scientists began to realise that the problem solving power of a program comes from the knowledge it possesses.

not just from the formalisms and inference schemes it employs. The conceptual breakthrough that "to make a program intelligent, provide it with lots of high quality, specific knowledge about some problem area" was made, and this realization led to the development of special purpose computer programs, systems that were expert in some narrow problem area. These programs were called expert systems.\textsuperscript{32}

Edward Feigenbaum (in a paper at the International Joint Conference on Artificial Intelligence in 1977) emphasised the fact that the real power of an expert system comes from the knowledge it possesses rather than the particular inference schemes and other formalisms it employs\textsuperscript{33}. This new view of AI systems marked the turning point and formed the basis for development of domain specific knowledge based systems. This in turn has led to more emphasis being placed on research related to knowledge representation and the use and manipulation of knowledge.\textsuperscript{34}

Some authors recently extended the definition of DSS to include any system that makes some contribution to decision making; in this way the term can be applied to all but transaction processing systems. The review of the existing literature reveals the fact the academics and visionaries develop a theoretical definition that


\textsuperscript{34} Dan W. Patterson,"Introduction to Artificial Intelligence and Expert Systems",Printice Hall of India,1992,p 13
imposed high and exacting standards and the practitioners have given a pragmatic
definition with an emphasis on the application of the system with the standards possible.

Electronic Data Processing was first applied to the lower operational
levels of the organisation to automate the paperwork. Its focus was on data. The MIS
approach elevated the focus on information systems activities with additional emphasis
on integration. This was aimed at the satisfying the information requirements of
managers.

The focus of the decision support systems is not restricted to particular
level of hierarchy in the organisation but on the activity of decision making that may be
carried at any level.

Improving the performance is ultimate objective of a system- not the
storage of data, production of reports, or even getting the right information to the right
person at the right time. The ultimate objective must be viewed in terms of the ability of
information systems to support the improved performance of people in organisation.

Systems to support the communication needs of the organization are
evolving rapidly from advances in telecommunications. Decision Support Systems(DSSs)
seems to be evolving from the coalescence of information technology and operations
research/ management science approaches in the form of interactive modeling. A DSS is
thus a class of information system that draws on transaction processing systems and
interacts with other parts of overall information system to support decision making activities of managers and other knowledge workers in the organization.

The review of the existing literature on the DSS also indicates the fact that there are three levels/types of software which have been included in the label "DSS". They are used by people with different levels of technical capability, and vary in the nature and scope of task to which they can be applied. They are: Specific DSS, DSS generator, DSS tools. Specific DSS is a system that actually accomplishes a particular task in a specific narrow domain or a problem area. DSS generator is package of software that provide a set of capabilities to build a specific DSS (these can be set of statistical routines and subroutines). DSS tools are the most fundamental level of software elements which facilitate the development of specific DSS or DSS generator and include the special purpose languages.

Expert systems capture not only the knowledge of a human expert, but also the rules that he uses to reach conclusions. The Two main components of an expert system are the knowledge base and the inference engine. The rules used by an expert and his knowledge are captured and this knowledge represented in the required form for the inference engine to read, becomes the knowledge base. The general reasoning strategies are separated from the knowledge base so as to allow the system to use knowledge in a variety of ways. Since the knowledge base and inference engine are separate, an inference engine can be bought to be used in association with other databases. This is called a shell.
A surprising fact about expert systems is that although they have inspired a number of new programming languages and powerful new computer architectures, they have made virtually no progress in the domain of marketing and while most interested parties view them as potentially powerful way of beating the competition, there are few products available.\footnote{Foster, E., Artificial Intelligence, Personal Computing, John Wiley & Sons, England, 1985.}

The reasons for the same are the beliefs that the marketing function/operations can not always be reduced to a set of definite rules and managers make many decisions based on their intuition/ gut feeling. Management problems do not lend themselves to quite the seem precise logic as the scientific problems. Every application of knowledge is not reducible to discernible routines.

While the above are true to an extent, the fact is that every decision activity in marketing is not revolving around the intuitive artistry, to fall outside the boundary of technical rationality. Also, a heuristic differs from an algorithm in that it does not always give a correct answer, nor does it guarantee results. It merely suggests a general direction that is more or less likely to prove more useful than another direction. The fact is that even heuristics can be represented in the form of knowledge. This gives probable solutions (in stead of precise solutions) to less rigorously defined problems that are too complex to be dealt with algorithmically. One of the key attributes of knowledge is its context sensitivity (it is very tightly bound to the context) and action in the face of
changing contexts, requires judgment, an extremely fuzzy capability. Some contexts can be captured with the content but will have drawbacks as they are not exhaustive.

As markets become more fragmented and competitive, and consumers more sophisticated, marketers need to adopt a more scientific approach to understanding marketing complexity, to deliver long-term dependable and controllable growth.

Companies across all industries are facing the pressure of increasing competition, whether it is from technological development, modified regulation or market globalisation. The solution or the competitive edge comes from the information technology in the form of Expert and Decision Support Systems.

Evolution of Expert Systems

Knowledge based systems based on artificial intelligence in the form of Expert Systems have been in commercial use for over a decade. More than a thousand systems are now in practical use in a wide range of applications in industries on all continents. However, few companies use Expert System technology effectively, because the majority are still uncertain of how to apply AI and what extent it can be useful. Most of today's systems are quite simple and relatively small, but are still very useful. All of the existing expert systems provide automation of only tiny areas of expert knowledge. Expert systems at present are only suited to providing support to competent knowledge workers responsible for performing particular functional tasks.

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The technology represented by current ESs is an outgrowth of AI techniques that have been the subject of intensive research since late 1950s. Related research began in the area of languages to support symbolic reasoning. The programming language IPL, the first symbolic list processing language, was used extensively in early AI implementations. Lisp, currently one of the most popular languages for AI, was developed by John Mc. Carthy in 1958.

Research specific to ESs actually began in the middle of 1960s. Several systems were developed between 1965 and 1970; most of them were very limited in scope and were directed toward games or highly academic, idealised subjects. Although ES development is still relatively new, there are currently many ES in use by a wide variety of organizations for many different applications.\(^{37}\)

Expert Systems first emerged from the research laboratories of a few leading US universities during the 1960s and 1970s. They were developed as specialised problem solvers which emphasised the use of knowledge rather than the algorithms and general search methods. This approach marked a significant departure from conventional Artificial Intelligence systems architectures at the time. The accepted direction of researchers then was to use AI systems that employed general problem solving techniques rather than specialised domain knowledge and heuristics. This departure

from the norm proved to be a wise choice. It led to the development of new class of successful systems and special systems designs.\textsuperscript{38}

The systems that form much of the technical and historical base of ES technology are presented below.\textsuperscript{39}

\textbf{TABLE 1.1 HISTORICAL BASE OF EXPERT SYSTEM TECHNOLOGY}

<table>
<thead>
<tr>
<th>SYSTEM</th>
<th>DATE</th>
<th>AUTHOR</th>
<th>SUBJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dendral</td>
<td>1965</td>
<td>Stanford</td>
<td>Infers information about chemical structures.</td>
</tr>
<tr>
<td>Macsysma</td>
<td>1965</td>
<td>MIT</td>
<td>Performs complex mathematical analyses.</td>
</tr>
<tr>
<td>Hearsay</td>
<td>1965</td>
<td>Carnegie Mellon</td>
<td>Natural language interpretation</td>
</tr>
<tr>
<td>Mycin</td>
<td>1972</td>
<td>Stanford</td>
<td>Diagnosis of blood diseases.</td>
</tr>
<tr>
<td>Teiresias</td>
<td>1972</td>
<td>Stanford</td>
<td>Knowledge transformation tool.</td>
</tr>
<tr>
<td>R1</td>
<td>1978</td>
<td>Carnegie Melon</td>
<td>Configuration of DEC computer equipment.</td>
</tr>
<tr>
<td>Caduceus</td>
<td>1975</td>
<td>Univ. of Pittsburgh</td>
<td>Diagnostic tool for internal medicine.</td>
</tr>
</tbody>
</table>


Justification for Knowledge-based systems/ Business Considerations

Managing knowledge is becoming a concern for many firms. Preserving knowledge that otherwise may escape or erode, building knowledge as experience is gained and distributing it to the points where it is used are becoming important issues. In many cases, the only approaches to addressing these issues are based on applied Knowledge Based System (KBS) technology in the form of professional knowledge, task analyses, knowledge encoding. Expert systems techniques can be used to preserve and disseminate scarce expertise by encoding the relevant experience of an expert and making this expertise available as resource to the less experienced person.

Expert systems strengthen the capability to manage complex operations and decision making where large amounts of information have to be taken into account. They help provide high knowledge content services with less trained people. The timeliness and responsiveness of customer service can be improved. They help preserve and accumulate knowledge from departing or promoted personnel.

Applications are the reasons for the existence of Expert or decision support systems. The payoff of the applications are the payoff from the Expert systems. The business value of knowledge and automated knowledge must be judged according to the operational goals of each organization. Benefits from the KBS applications are usually broader than those from conventional systems that automate the clerical or
transaction functions. Many KBS automate the parts of human intellectual functions to aid knowledge workers in performing their tasks. As a result, they tend to have more far-reaching impact on any organization's performance than conventional systems.

However, the traditional cost-benefit analysis is not well suited to the Expert or Decision support systems. The benefits they provide are sometimes qualitative. It is difficult to place a specific value on these qualitative advantages. In addition, most DSS evolve. There is no final system; an initial version is built and new facilities are added in response to users' experience and learning. This requires a focus on value and recognition that qualitative benefits are of central relevance and that it represents an investment for future effectiveness.

Knowledge Engineering:

A well-known procedure for evaluating the level of success of an AI program is the Turing test. In the Turing test a human interrogator communicates via text input and output, with an AI system and with another human who is participating in the test. The interrogator is not aware of which responses come from the computer and which come from the human. If after, sufficient questioning, the interrogator cannot differentiate between the human and the computer, then the AI systems passes the test and is deemed successful. No existing AI system would pass a true Turing test, nor is it likely that there will be such a system in the foreseeable future. Although the Turing test is interesting,
especially from a philosophical viewpoint, it is fortunately possible for Expert System to be of great practical value even though it fails such a test.

The fact is that the ES addresses a specific problem domain and it does not attempt to approach human capabilities in all areas. 41

Early researchers in AI believed that the best approach to solutions was through the development of general purpose problem solvers. Their attempts to build such systems failed and the realization that specific knowledge was needed to solve difficult problems gradually brought about the use of domain specific knowledge as an integral part of a system. It eventually led to what we now know as knowledge based systems.

Knowledge-based systems get their power from the expert knowledge that has been coded into facts, rules, heuristics and procedures. The knowledge is stored in a knowledge base separate from the control and inferencing components. This makes it possible to add new knowledge or refine existing knowledge without recompiling the control and inferencing programs. This greatly simplifies the construction and maintenance of the knowledge based systems. Knowledge forms the cornerstone of an Expert System's power. To actually realize this power, we must be able to abstractly represent knowledge and use the knowledge to support the system's reasoning process.

The following chapters present the basic issues of knowledge representation and describe

several methods of knowledge representation. A knowledge representation encompasses:

The structure used to describe elements of knowledge and the interpretive process required to use the described knowledge.

**Representation of Knowledge**

Given the fact that knowledge is important and in fact essential for intelligent behaviour, the representation of knowledge has become one of AI's top research priorities. The representation schemes that have become popular with AI scientists are: First order predicate logic, frames and associative networks (also called semantic and conceptual networks), fuzzy logic and object oriented methods. A choice of representation will depend on the type of problem to be solved and the inference methods available. There is no universally accepted "best" representation technique and one scheme will be more applicable than another when evaluated relative to specific domain.

**Knowledge Manipulation**

Decisions and actions in knowledge-based systems come from manipulation of the knowledge in specified ways. This requires that known facts in the knowledge base be located, compared (matched) and possibly altered in some way. This process may set up other sub-goals and require further inputs and so until a final solution is found. The manipulations are the computational equivalent of reasoning. This requires a form of inference or deduction, using the knowledge and inferring rules.
All forms of reasoning require a certain amount of searching and matching. In fact these two operations by far consume the greatest amount of computation time of AI systems. For this reason, it is important to have techniques available that limit the amount of search and matching required to complete any given task. Much research has been done in these areas to find better methods. The research has paid off with methods which help to make many otherwise intractable problems solvable. They help to limit or avoid the so-called combinatorial explosion in problems which are so common in search.

First Order Predicate Logic (FOPL) was developed by logicians as means for formal reasoning and today it has assumed one of the most important role in AI for the representation of knowledge.

Familiarity with the FOPL is important for the study of AI for several reasons. First, logic offers the only formal approach to reasoning that has sound theoretical foundation. This is especially important in our attempts to mechanise or automate the reasoning process in that inferences should be correct and logically sound. Second the structure of FOPL is flexible enough to permit the accurate representation of natural language reasonably well.

Object Oriented Knowledge Representation: The object oriented approach to knowledge representation provides ways to represent both declarative and procedural knowledge about objects or entities. Objects are grouped into classes, sub-classes and so forth, thus forming hierarchy of object classes. The unique attributes or characteristics of
objects at each level in the hierarchy are specified in the knowledge base definition. A subclass inherits the properties of its parent classes and all classes above it. Inheritance of the properties is automatic, but may be overridden in special instances in which the subclass does not exhibit certain properties of the parent class. The last level in the hierarchy corresponds to "object instances" or the actual objects themselves.

The most distinctive feature of the object oriented approach is the ability to represent procedural knowledge concerning the behaviour of objects. One way of representing procedural knowledge is "message-passing", which permits objects to communicate with each other and cause action to be taken through special attributes that are actually procedures or algorithms.

**Semantic Networks**: This form represents knowledge through graphs consisting of nodes and arcs representing the relationships between word concepts (semantics). Nodes represent fact descriptions (objects, concepts, situations), whereas links represent relationships between nodes. This approach is appropriate for declarative knowledge organised around objects (nodes) and relationships between objects (links). Semantic networks are useful for a variety of operations. They support reasoning because patterns can be matched to retrieve information. They can also support inference through derivation of general properties by examining a set of nodes for common features and relationships. They can support deductions by providing a network of relationships leading to a derived conclusion. However, semantic networks have not been commonly
used for business applications, because exception handling is difficult, control is more involved and explanation of logic is more difficult than is the case with production rules.

Frames: Humans have the important ability to interpret new situations on the basis of knowledge gained from experience in similar situations. This ability allows our knowledge to grow with each experience rather than start from the initial conditions in every case. For example, based on our past experience with them, we expect cars to have wheels and an engine, to require fuel to move. These elements are defining characteristics that when taken as a whole constitute our understanding of "car". They are our expectations regarding a car - the things that, unless there is evidence to the contrary, we expect to be true of all cars.

We maintain large mental collections of knowledge structures that include these expectations as default values for the corresponding characteristics. A frame is a structure for organising knowledge - with an emphasis on default knowledge. Frames share several concepts in common with semantic nets. Each frame represents a class of elements in a semantic net. Frames are used for organising our basic understanding of the things that are typically true of some general class of elements.

A frame consists of a series of slots each of which represents a standard property or attribute of the element represented by the frame. A slot gives us a place to systematically store one component of our past experience regarding represented class of elements.
Each slot is identified by the name of the corresponding attribute and includes the value or range of values that can be associated with the slot. A default value for the slot may be indicated. Slots may also be filled with lower level frames. A frame system is composed of the interrelated frames that are required to represent a domain.

Production Rules: Production rules are the most common type of knowledge representation used in business expert systems. They consist of if-then-rules. This approach is good for representing procedural and/or factual knowledge. Systems using this form of knowledge representation operate by inference engine checking rules. When all required rules are true, conclusions are inferred.

However, to minimise the reasoning time, search control methods are used to determine where to start the substitution process and to choose which rule to examine next when several rules are conflicting at the same point. The two main methods of search are forward and backward chaining. These two methods of chaining may be combined in an expert system for maximum efficiency.

**FORWARD CHAINING:** When the rule interpreter is Forward chaining, if premises clauses match the situation, then the conclusions are asserted. Once the rule is used or fired, it will not be used again in the same search; however, the fact concluded as the result of that rule's firing will be added to the knowledge base. This cycle of finding a matched rule, firing it and adding the conclusion to the knowledge base will be repeated until no more matched rules can be found.
BACKWARD CHAINING: A backward chaining mechanism attempts to prove the hypothesis from facts. If the current goal is to determine the fact in the conclusion(hypothesis), then you must determine whether the premises match the situation.

Forward Chaining is often called data-driven inferencing because it starts with data and checks to see what conclusions can be reached. Backward chaining systems use goal-driven inferencing. They begin with a goal or conclusion and attempt to establish support for the conclusion.

The Functional Development Process of an Expert System


Application Selection:

One of the most important functions to be undertaken when introducing an expert system into an organization is the selection of the applications. The applications chosen should have the following characteristics:

- Automation of the task must matter: the benefits from automation must be important to the organization in economic or strategic terms.
• The knowledge must exist: the valuable expertise must exist and be available for inclusion in Knowledge Based System through elicitation from experts or in other ways.

• If the KBS is built and deployed, it must be possible to use it in the work setting to obtain the desired benefits.

• Implementation of the KBS must practicable with the techniques and resources available.

• It must not be possible to realize the benefits or perform the function using simpler approaches.

• The KBS application should be of significant business value to the organization

Task Environment Analysis and modeling:

Task environment analysis and modeling involve identifying the intellectual, clerical, informational and physical functions involved in performing the business task that may receive expert system support. The three major functions of task environment analysis are:

1. Task environment interviews provide collected materials on what the task is, how it is performed etc. Deliverables include identification of task performers, transcripts from audio and video recorded elicitation sessions with managers, supervisors, experts, users and people who work in adjacent functions to the one under analysis, identification of artifacts used, work flows, organization, people's roles etc.
2. Task environment analysis provides definitions and descriptions of business roles, language and terms used by the experts, actions performed during task execution, objects, tools and artifacts used and task concepts.

3. Task environment modeling provides a model of the different elements of the task environment and their operational relations. Task environment models typically include descriptions of task functions, symbolic actions, mental operations, information flows and processing, work flows and relations between sub-tasks and adjacent tasks.

**KBS Conceptualisation:**

The Knowledge Based System is conceptualised with several considerations in mind: What the nature of the business functions will be after the KBS has been implemented; the role and function that the KBS will play a role and function that the KBS will play in support of the functional tasks to be performed: the nature and extent of knowledge and reasoning that should be considered for automation in support of the task; whether or not the knowledge is verbal, visual or kinesthetic, whether reasoning refers to bounded or unbounded domains and if it includes common sense or perceptual recognition.\(^{42}\)

**Elicitation and acquisition of Knowledge and task environment particulars:**

The purpose of knowledge elicitation is to obtain knowledge from experts, their supervisors and other knowledgeable individuals who support the...
functional task under consideration. Knowledge elicitation is also performed to support knowledge analysis and modeling. Domain knowledge may be acquired in several different ways. The major of the knowledge elicitation methods for different types of knowledge are presented below:

**TABLE 1.2 KNOWLEDGE TYPES & KNOWLEDGE ELICITATION METHODS**

<table>
<thead>
<tr>
<th>Types of knowledge</th>
<th>Interviews</th>
<th>Observation</th>
<th>Simulation</th>
<th>Protocol analysis</th>
<th>Interactive prototyping</th>
<th>Extraction from codified sources</th>
<th>Machine induction</th>
<th>Self elicitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facts</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Heuristics</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Concepts/relationships</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Classification</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meta-Knowledge</td>
<td>X</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem-negotiation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User characteristics</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procedural knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tacit knowledge</td>
<td>X</td>
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<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Note: 'X' represents that the method is suitable for elicitation of type of knowledge.

It is possible, however, to get good insights into many types of knowledge using most of these methods, event though they are better suited to support elicitation in the areas shown.43

An additional consideration in the selection of elicitation method is the type of knowledge holder. Different type of knowledge holders have very different ways of communicating. Their abilities to explain and conceptualise vary considerably and it
is therefore necessary to match the elicitation method to the expert's style. When selecting the elicitation method, it should also be remembered that the expert's often have "compiled" their knowledge; the knowledge has been restructured and automated and in the process the experts have lost their capability to explain what they know. It is generally difficult to elicit deeper and more abstract knowledge during interviews.

Knowledge analysis and modeling:

Knowledge analysis and knowledge modeling serve several purposes. A knowledge model is made, in preparation for systems design, as a formalised restructuring or codification of the expert's domain knowledge. In this form it is of value for examination, authentication and expansion of the domain knowledge included in the system. The domain knowledge is restructured in the knowledge model and is useful in identifying new computational processes, new divisions of tasks and cognitive functions required to perform the work desired.

Restating domain knowledge declarations in the form and syntax required by the chosen software is what remains to be done as a final step.

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