MARKETING INFORMATION SYSTEMS:
AN ANALYTICAL FRAMEWORK

by

CHAN KING FOOK

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--- Chan King Fook ---

Department of Commerce and Business Administration.
The University of British Columbia
Vancouver 8, Canada

Date 29th, October, 1969.
ABSTRACT

This study is concerned with the management of marketing information flows. The problem of information management has been precipitated by such factors as improvements in information-handling technology and hardware, the 'information explosion' from sources within the economic, social and political sectors, the increasing complexity of business systems, the emergence of the 'marketing planning' concept, and the shortcomings of traditional marketing research. This problem was then viewed from a systems perspective. A conceptual framework for managing information flows was developed from a systems analysis of the marketing process. The use of a module framework led to the consideration of a formalized information system within the company's organizational structure. Theoretically, a marketing information system would collect, process, analyse and disseminate timely and pertinent information. This theoretical framework was supplemented by a case study of a company actively engaged in the application of information system services to marketing management. The conclusions, albeit limited to this one case study, attempted to highlight what are suggested as significant pointers for marketing information system development. Generally, the conclusions show that while the practice tended to support the theory in broad principles, the actual operating principles of an information system would reflect the peculiar needs, advantages and constraints of the company.
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INTRODUCTION

Management decision-making processes are normally based on some sort of information inputs, the alternative being an intuitive or 'seat-of-the-pants' approach. To become more rational in their decision-making processes, managers require adequate, timely and pertinent information. However, such 'correct' or even 'complete' information does not necessarily lead to 'correct' decisions because of the unpredictable human factor (i.e. management) present. Notwithstanding this, the objective here is to emphasize the need of generating information as a sounder basis for decision-making.

In the area of marketing, several authors have commented on the failure of traditional marketing research in fulfilling this information need (e.g. Adler, 1960; Newman, 1962). Hence, there has been a recent trend towards advocating the establishment of an information system for marketing with a formal home in the organization structure.

Information systems can be related to either strategic planning and management control or to operational control. These are terms used by R. Anthony in his book "Planning and Control Systems." Strategic planning is the process of deciding on objectives and policies and has to do with major decisions of a long-term nature. Management control is the process of obtaining and using resources to accomplish the objectives set and has to do with the short-term operation of the firm. Both these processes overlap to a great extent and are normally in the province of top and middle management. Operational control is the process of ensuring the efficiency and effectiveness of individual, specific tasks. This is typically a
daily operational task performed by lower supervisory levels.

The present study will be oriented to information systems for strategic planning and management control. Since these terms are highly interrelated and difficult to demarcate clearly in practice, the definition given to the word 'planning' (see page 1) attempts to overcome this difficulty by incorporating both the planning and control concepts.

In this context, the following definition of an information system (as developed by Smith, Brien, and Stafford, 1968) will be used:

A structured, interacting complex of persons, machines and procedures designed to generate an orderly flow of pertinent information, collected from both intra- and extra-firm sources for use as the bases for decision-making in specified responsibility areas in marketing management.

The objective of this thesis is to investigate the significant theoretical developments of the marketing information systems concept and to correlate these developments to a practical situation.

Chapters One to Four will dwell on the general problems of information management and on the development of a conceptual framework to handle the problem.

Chapters Five and Six concern a case study of such a marketing information system as recently instituted by Monsanto Canada Ltd. The conclusions arrived at will thus only reflect the research done on this one case study. It will be a study of how the organization communicates and processes information, especially pertinent to top-level planning, in an attempt to maximize effective decision-making.
CHAPTER I

THE MARKETING CONCEPT, MARKETING PLANNING
AND INFORMATION FLOWS

The birth of the 'marketing concept' has prompted the idea of the firm as not merely producing goods and services "...but as providing customer creating value satisfaction." This necessitates orienting all marketing decisions towards consumer needs, wants and values. Operationally, this means the integration of major marketing decision areas into a cohesive marketing plan. Sub-optimization in any decision area may lead to a conflict of interests, inevitably resulting in an incorrect strategy in the light of consumer needs and of competition.

Marketing also must viewed in relation to other functional areas of business e.g. production and finance. The marketing concept further demands integration of total company effort to achieve its goals. This is made difficult by the complexity and diversity of typical large-scale firms. But such considerations cannot be ignored: "...The two factors of organizational complexity and market orientation re-inforce the essentiality of the same function--marketing planning."  

Basically, planning is the process by which the entrepreneurial and technical abilities of the firm are applied to setting for the company

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goals and policies, assessing market opportunities, generating possible strategies to achieve these objectives, designing detailed marketing programs, integrating the individual programs into a marketing plan, and adjusting the plan to changes in the environment. Underlying the planning, control and adjustment processes is a need for information as decision bases. More importantly, it emphasizes the need for constant collection and use of pertinent information.

For example:

...the first step is usually identified as the determination of the goals or objectives that are to be accomplished by the marketing plan. This is true only to the extent that the firm has the results of a careful review of its present position as a foundation upon which to determine realistic goals and feasible objectives. If the firm is not fully aware of the characteristics of its current position in the market, such pre-planning analysis must precede the process of goal definition.3

In this context then, information can be regarded as:

...purposeful or goal-related knowledge, syntactically as symbols, semantically as data, and pragmatically as goals themselves or as knowledge about the degree of goal achievement.4

Management is typically involved in the functions of planning, organization, control and communication. Their information needs are determined by the particular decisions they undertake. Top management is normally engaged in the formulation and execution of long-run marketing plans whereby policies and strategies are set; middle management is normally the operative level dealing with the shorter-run tactical marketing program. For marketing as an entity, to initiate a new marketing

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plan involves decisions on the following factors:\(^5\)

1. **Marketing Program**

   The tactics directing the firm from where it is to where it wants to go, and involves decision-making in what are normally termed the marketing functional areas--product planning and development; pricing policies; distribution policies and promotion.

2. **Amount Budgeted**

   The amount budgeted for marketing functions within a time period for a product. Common methods used are the percentage of sales, all-amounts-available, and comparative parity methods. This assumes information pertaining to analysis of sales volume, market share, cost of sales is available.

3. **Allocation of the Budget**

   (a) Allocation of the budgeted amount over geographic markets. Usually, this is done by allocations according to market potential. J. Howard states that consequently, this appears to be a neglected decision area as often the use of measures of industry efforts and sales in any geographic location could alleviate this problem.\(^6\)

   (b) Allocation of the budget over time. In this area, information pertaining to time lags, product life cycles, industry cyclical

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variations are important aids to marketing planners.

The types of information needed could conceivably then include a very wide classification. However, the organization is generally divided into different levels of management. Each level would then need to receive only information that is essential to their areas of responsibility.

This raises the need for management of information. Though there are problems inherent in information collection, much of the essential information can be gathered on a continuous basis from store audits, salesmen reports, field surveys and promotional audits. However, C. Sevin has found that:

...that part of the total marketing effort of the firm which was expanded during any time period on each product or customer class or sales territory is generally not known. For example, single-product marketing—cost figures now generally available in most firms are patently inaccurate and misleading. Correct and useful determinations of marketing costs and net profit contributions for individual products in the multi-product firm require sophisticated analytical techniques which are not generally used.7

Such information is generally available from the firm's internal accounting department. But accounting procedures are not by nature designed to fulfill marketing information needs. This raises another problem in information management—the ability to locate and secure information pertinent to marketing.

CLASSIFICATION OF INFORMATION FLOWS

Before developing a conceptual framework to deal with the problem

of information management, an examination should be made of the various
information flows existing in a company at any point in time. This will
provide a guide in locating the sources, direction, and destination of
information flows.

There are arbitrarily three methods of classifying information
flows.

1. Internal and External Information Flows

   FIGURE I

   INFORMATION FLOWS

   ![Diagram of information flows](image)

   (a) Internal Flows

   This consists of flows between relay points within the firm.
   Generally, it is a composite of inward information flows from an external
   source i.e. the environment, and internally-generated information poten­
tially germane to marketing e.g. product improvement, manufacturing
   figures.

   There are three flow directions within a firm--downward, upward and
   horizontal (See Fig. II).
It is generally assumed that all three directional flows are along formal lines in the typical pyramidal organization chart or by informal channels.

Upward flows provide a basis for evaluating the extent to which targets have been achieved, incurred costs of production, morale, etc. These inquiries are normally compressed within reports from the accounting, finance, promotion, sales and production departments. Such data enables analysis of the firm's performance and resource utilization.

Downward flows usually consist of communications from top-level management down to lower-level management.

Horizontal flows occur when personnel on the same organizational level communicate with each other.

Figure II also shows the relationship between information needs and various management levels. This relationship is represented by the inverted pyramid. Top managerial levels require more planning information,
while lower levels require more operating data being involved in the actual daily operations. Thus implied here is that top management requires information which usually originates from the environment.

(b) **External Flows**

This consists of outward and inward flows between the firm and its environment (See Fig. I). Examples can be cited of the inward type (marketing research) and the outward type (advertising).

Outward flows are termed marketing communications and consist of information about the firm and its products flowing to the environment. The usual vehicles of communications are advertising, personal selling and public relations.

Inward flows consist of marketing intelligence which embraces raw data, summaries, research reports, inferences, rumours, etc. The information flow here can be further classified into primary and secondary data. Primary data are that which are directly related to the firm and its products e.g. surveys indicating dissatisfied consumers, rumours of a new competitive product. Secondary data are then indirectly related to the firm, though nonetheless important in its planning implications e.g. economic indices such as population growth rates, income per capita, retail/wholesale trade figures. Arbitrarily, there can be delineated nine major sources of inward, external information flows—the broad environment of the economy, technology, culture, law and the immediate environment of competitors, channels, complementary producers, suppliers and markets.
2. **Planning and Control Information Flows**

   This method of classification bears directly on two important management functions.

   (a) **Planning Flows**

   This comprises the body of facts required to set objectives, formulate strategy and to decide between alternative courses of action. It is concerned with historical data only as an indication of the future. It stresses the importance of non-financial data and shows trends over long periods of time.

   There are three basic types of planning information:

   (i) **Self-analytic information**

   This is composed of information on company resources, sales, costs, share of market, production capacity, distribution channels, company/product image and on labour availability. These provide for assessment of new market potential, production schedules, sales organization, new product development, as well as for appraising present market effectiveness.

   (ii) **Competitive information**

   This covers information relating to competitors, e.g. their profitability, share of market, advertising campaigns. Included here would be any form of unsolicited or incidental information on competitive plans and action. Together with the self-analytic

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8 This classification was developed by F. A. Lindsay, "Marshall Your Marketing Information," in *Business Horizon*, Vol. 5, No. 2, Fall, 1962, p. 55.
information, they present a basis for decisions on marketing plans.

(iii) **Circumambient information** (or secondary external flows)

This covers the facts on the entire economic situation e.g. general price levels of retailers/wholesalers, government price regulations, population growth rates, wage rates, transportation facilities. This is similar to the secondary external flows discussed above.

(b) **Control Information**

Basically, control information has to do with the progress of the firm or product in comparison with the plan. Control information can be internally-generated data on the firm's performance with regards to allocation of finance, materials, labour and externally-generated information on the extent of impact of the marketing plan.

At the operative management level, we can speak of physical control methods e.g. inventory level control or production level control. Higher levels of management are often involved in a more abstract level of control. For instance, marketing management has authority over the marketing functional areas. Decisions regarding pricing or advertising are generally responses to a particular market situation. The strategy might be to institute a specific response to each situation. Information is thus needed on the current progress of the marketing plan in such surrogate terms as sales, consumer actions and attitudes, market-shares, distributor performances, etc.
3. Planned and Unsolicited Information Flows

(a) Planned Information

This refers to that information which is specifically requested by management and may take the form of inward external flows or internal flows. Its collection is accomplished through some kind of organized research effort and systematic data gathering. If required, this information should be presented on a regular basis.

(b) Unsolicited Information

Unsolicited information refers to that which exists within the firm, but which management does not realize is available. The flow of such information depends on the extent of integration amongst the information channels and the clarity of communication among departments and among personnel. Often, distortion in communications occurs between source and destination and information is received in a form entirely different from that intended by the source.\(^9\)

At any point in time, all or some of the above information flows would exist in a company. They could be present in any combination of the three classifications e.g. planning and control data could originate from internal or external sources on a planned or unsolicited basis.

The preceding discussion has further emphasized the need for management to obtain decision-pertinent information in an appropriate, timely and adequate form:

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...Unless the information subsystem is effectively integrated into marketing strategy, a company cannot hope to fully achieve the goals it has set for itself.\textsuperscript{10}

MARKETING RESEARCH AND INFORMATION FLOWS

Next, we will consider whether the traditional marketing research approach has adequately fulfilled the information needs of management.

Marketing research has been defined as:

...the systematic gathering, recording, and analysing of data about problems relating to the marketing of goods and services.\textsuperscript{11}

Generally, it carries out special field projects and generates reports and analyses of sales, consumer attitudes and behaviour, etc. However, it ordinarily does not implement a continuous search for information as:

...there is a widespread failure to visualize marketing research as a continuing process of inquiry in which executives are helped to think more effectively.\textsuperscript{12}

Marketing research departments generally lack—both in spirit and form—a conception of itself as the total information arm of the marketing executive.

Five major reasons have been forwarded by L. Adler as to why marketing research is out of step with marketing in most firms:\textsuperscript{13}


1. Pre-occupation with the gathering of unrelated facts and isolated segments of information.

2. Concentration on short-run problems to the virtual exclusion of long-run planning research.

3. Pre-occupation with vigorous methodology and reliability of data.

4. Tendency to specialize on a particular problem or problem-type.

5. Fragmentation of the research function even farther by the development of new research techniques.

J. Newman cites several reasons contributing to the frequent lack of communication between marketing research personnel and top management:

1. Marketing research has developed new techniques and concepts which top management often fail to follow.

2. The marketing executive views these advances as a threat to his traditional decision-making responsibility under uncertainty, because research aims to remove as much uncertainty as possible.

3. Marketing planning is not carried out systematically in many firms and thus, long-run objectives are absent. Information needs tend to be short-run and this is reflected in the types of marketing research done.

4. An inability to attract research personnel who possess the broad viewpoints necessary to integrate information flows and needs because of the low status placed on the marketing research function. Thus the research staff have no direct access to top management.

Presently, two important factors have shed new light on the problem of maintaining effective information flows. Recent advances in data processing equipment has brought upon what is termed the "Age of Information." Computers and other hardware are now available for efficient storage, analysis and dissemination of immense amounts of information.

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Coinciding with this is the fact that information from such sources as government agencies, statutory boards, commercial research agencies are growing in volume at an exponential rate. These two factors have decreased the need for data collection, and increased the need for information management.\(^{16}\)

In an unmanaged information set-up, three problems could arise with respect to collected information: \(^{17}\)

1. information disappearance,
2. information delay, and
3. information distortion.

The usual complaints encountered in firms are wrong information, inability to locate information, suppression of information (due to ignorance or personal reasons) and a lack of the idea of reliability of validity of the information.

Often, management is complacent about such problems, resting on the beliefs that information will ultimately flow to the correct user, that collection by respective decision-makers is the most efficient and that any attempt at instituting a managed information flow may result in a manipulation of data for personal reasons.

But P. Kotler feels that:

...these premises are wrong. Key executives are often abysmally ignorant of important marketing developments; they do not always make optimal use of existing information in passing it on. A systematic solution to these problems is absolutely necessary if

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executives are to make effective and swift marketing decisions in an age characterized by intensifying competition, frequent product changes, and complex and shifting consumer wants.\textsuperscript{18}

CHAPTER II

SYSTEMS APPROACH TO MARKETING AND THE MANAGEMENT
OF MARKETING INFORMATION

The problem of generating adequate and decision-pertinent information must and now can be viewed from a broader perspective--that of the 'systems concept.' This concept has seen many interpretations in the literature. For the purposes of this paper, many of the ideas and terminology are borrowed from the work of J. Sutherland.1

THE SYSTEMS CONCEPT

A system is defined as: "...an assemblage of objects...united by some form of regular interaction or interdependence." (Webster's New Collegiate Dictionary). According to this definition then, the marketing process can be perceived to constitute a system. The interaction of elements such as product, price, sales, distribution, promotion, etc. broadly fits the definition.2 A marketing system is then any group of marketing elements and actions that can be physically or conceptually delineated.

The prime determinant for systems analysis is its placement along a continuum ranging from negligible to complex change. Where a system is


placed depends on the complexity of its ecological, dynamic and domain dimensions. In between the two extremes, a system can manifest any combination of degrees of complexity in its three dimensions.

**Ecological Dimension**

This dimension refers to the relationship (or interface) between the system and its environment. It is the external configuration of the system. If a system has little or no interaction with the environment, it is considered a closed system. An open system would then be one where a great deal of interaction occurs.

If a system is to trade resources, energy, or information with its environment, it would need to be integrated or interfaced with the environment. It is via these interfaces that the open system relates to the environment and adapts to changing external conditions. The ecological dimension can be complex or simple. Where complexity prevails, the destiny of the system is probably determined exogenously i.e. the determination lies in the environment.

**Domain Dimension**

The domain refers to the actual or conceptual spacing of the system in the environment. It can be a physical space (e.g. geographical system) or a conceptual system (e.g. Mao's followers). The feature of an open system is that its domain must be able to adapt to the changing environment in order to survive. Where a system's domain can be called simple, it is then easy to analyze and to identify its components. The system parts would show a high degree of homogeneity and symmetry which makes for easier
prediction of the system. A complex system domain would then be not all of these and the interaction of its parts is likely to produce a result greater than the sum of its individual products. Hence the difficulty of inferring the whole from any observable part of the domain.

**Dynamic Dimension**

This refers to the structural change of the system between two points in time. It is important because system control demands knowledge on when, where, and how to intervene in its dynamics for regulation purposes. For instance, marketing research is like a snapshot at a point in time which illuminates the firm's system for a moment. But in between research problems, there could occur significant structural system changes of which management is ignorant. The use of an information system (see Chapter III) can then be likened to a steady glow which illuminates the system's dimensions constantly to enable charting a course through the environment.

Changes can emanate from internal or external system sources. A closed system would then have defined limits to its changes, whereas an open system is limited only by its adaptive capacity because changes can be caused by environmental variations. If change is consistent over time, this allows for easier prediction and control.

**Mechanistic and Gestalt Systems**

These three dimensions can then exhibit negligible or complex change. At one extreme where a system shows negligible change on all three dimensions, it is termed a mechanism of a deterministic system; at the other extreme where it shows complex change on all three dimensions, it is termed
a gestalt or a probabilistic system. The mechanism would be a simple system to administer as it is predictable to a high degree (e.g. a primitive society); whereas the gestalt is a system with a lower degree of predictability, certainly calculated to produce administrative nightmares (e.g. U.N.).

Figure III shows the graphic representation of the three dimensions and the essential mechanistic and gestalt planes. It also implies that a system may possess varying degrees of complexity for each dimension. However, this study will only utilise the idea of a gestalt and mechanism in stressing the complexities of present marketing systems.

FIGURE III
MARKETING SYSTEM ANALYSIS

It is contended that most multi-product firms operate in systems approaching the gestalt, as will be appreciated from an overview of the dimensions of a typical marketing system.

Ecological Dimension

Marketing systems are basically open systems. Thus planning is made inherently more difficult by the openness of the system. If the environment is characterized by complex changes, then a low degree of predictability turns the system into an administrative headache. The variables involved are in a constant state of flux and a change in one often effects others (e.g., change in consumer income affecting demand).

An important feature of marketing systems is the existence of complex intelligence networks which include multiple feedback and forecast loops:

...Normally feedback loops are thought of in terms of various marketing research, sales management, and distribution cost accounting which relate back to management information about events that have already occurred.³

Forecast loops apply to information on the future. Such feedback devices imply a communicative bridge (interface) between the system and its environment. Both types of loops facilitate some measure of control of the system by allowing deviations to be known and corrections to be made.

Domain Dimension

Complexity in the domain dimension arises from a diffused configuration of the subsystems, either physically (e.g. sales offices located over a wide area) or conceptually (e.g. a schism between the product planning and promotional functions because of managerial decentralization). This poses the problem of co-ordinating subsystems towards achieving the larger marketing system goals.

...Resources are allocated to functions which are involved in maintaining the marketing organization itself, achieving supporting marketing services, extending action which permit the use of effective striking power, but which are not directly goal-oriented functions.  

A conflict then exists in allocating resources for system integration and for system extension. Planning and control of a complex system domain in this respect is further compounded by incomplete information on the system dimensions.

Dynamic Dimension

This relates to competition and change. The systems approach introduces the need to plan for change through a dynamic marketing strategy, as competition and other environmental factors are often hostile to the system (e.g. note the diversification strategy of the tobacco companies). Structural changes of marketing systems are often determined by changes in the environment and where these are unpredictable, the system must be flexible enough to adapt. Adaptation implies a measure of control over the system e.g. management usually has control over its internal departments.

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Thus for most marketing systems, conditions tend towards the gestalt, where almost inevitably events are marked by randomness or stochasticity. However, management can learn the nature or pattern of such events over time. Such a learning process requires information for better decisions or adaptive postures. This introduces the concept of feedback as a planning and control device. The importance of feedback can be illustrated by analysing systems in a simple engineering module framework.

FIGURE IV

CLOSED SYSTEM MODULE

Input (I) is the means of triggering the system into operation as an on-going process.

Output (O) is the operating result.

Process (P) is the vehicle for the operational transformation of inputs into outputs and its organizational structure can be perceived to be the domain.

Feedback (F) is a means of monitoring the output and delivering the results back into the system for possible necessary corrections of future system operations.
In a closed system (e.g. a household heating system with a thermostat), feedback is mechanistic and the system adjusts automatically to corrective warning signals. Such mechanistic systems are predictable to a high degree.

In an open system (e.g. marketing), feedback is not mechanistic due to the lack of an automatic control device and the existence of environmental uncertainties. Hence, the need to introduce a Control Unit (CU) or regulating body into the system module which monitors the output and adjusts the input accordingly (See Fig. V).

FIGURE V

OPEN SYSTEM MODULE

The new property in Fig. V is the explicit inclusion of the Environmental Constraints (EC) on the system process. These are ambient environmental factors which set a limit to the system's activities. There is need also of monitoring these constraints to regulate the input function. The feedback from the output plus from the environment gives a basis for better planning and control in open systems. Marketing systems can now be analysed in this module form.
Output: The basic real output of the firm is the product it offers and secondary informational outputs consist of messages regarding its products and itself. Both outputs represent the means by which the firm seeks to exploit profitable market opportunities. Thus marketing subsystems such as sales and advertising, produce outputs which form interfaces with the market and become primary sources of feedback.

Input: It is convenient to trigger the system by introducing the product as the basic input. The product idea itself may come from sources internal or external to the company. This suggests that another important input is information, particularly with respect to the market, competition and the company's internal capacity. The availability, accuracy and timeliness of such information is the basis for successful system operations.

Process: The marketing organization is the processor of the system. Functionally, the process means the structure whereby the personnel of the organization are positioned to carry out the marketing tasks. Typically, the marketing plan is the physical expression of the process. Major subsystems include planning, marketing information, sales, advertising, product development and distribution. The actual subsystem interrelationships will not be considered. However, it is recognized that they are not simple sequential or parallel networks, but are complex sequential-parallel networks with interlocking feedback loops.

Control Unit: Marketing administration is the control unit. It's task is to ensure that inputs are adjusted according to feedback. Though this human element makes the system performance lack the machine-like efficiency of the closed mechanism, it provides a greater measure of flexibility and
adaptability.

**Environmental Constraints**: The marketing system operates within the boundaries imposed on it by a set of ambient environmental factors. Included here are factors such as legal, political, economic, social and technological constraints, which need to be considered in any marketing plan.

**Feedback**: Feedback provides information about the success of the marketing process as the basis for future marketing plans. The traditional manner of generating feedback was the use of marketing research. However, the shortcomings of the marketing research approach (see pages 13-14) had led K. Uhl to conclude that:

...The basic structural weakness in virtually every ill-informed firm has been the absence of one entity for processing marketing information. Such firms have been typified by the presence of uncoordinated bits and pieces of the information function scattered here and there.5

In another survey, D. Daniel6 found that in three firms, planning and control information were inadequate not in the sense of being insufficient, but lacking in its relevance to goal-setting, strategy and decision-making.

This leads to the introduction of another property into the module—an Information Processor (IP) which takes over the task of monitoring the Output and Environmental Constraints. (See Fig. VI). Such an information processor shall be termed an 'Information System.'

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FIGURE VI

OPEN SYSTEM MODULE WITH INFORMATION PROCESSOR
CHAPTER III

INFORMATION SYSTEMS: A GENERAL MODULE

The next two chapters will attempt to develop the conceptual framework of an information system. This chapter will discuss a general information system in terms of its boundaries and basic functional relationships as an on-going process. The next chapter will discuss information systems in the context of a marketing orientation and will be mainly based on concepts that have appeared in the literature so far.

MODULE

An information system for any organization will be preliminarily defined as a system that will provide management with the information needed for planning and with subsequent information to control the progress of the plan. Ideally, it would then possess the following capabilities:

1. Assess the results of plans, before and after implementation, in relation to the goals of the organization.

2. Measure the environment and larger system domain for information related to management planning and control.

3. React in an appropriate time-frame to enable corrections to long-term plans or short-term programs.

A convenient way to analyse the basic functional relationships of an on-going information system is via the system framework.

Input: Specifically, inputs are generally data, the basis of which can be traced to three circumstances--requests for specific information, regular
information needs and unsolicited information flows. It is then the purpose of the information system to transform these inputs into outputs.

**Output**: The principal output is then the information supplied to management. Specifically, it is the result after the functions of collecting data, analysing it, drawing inferences and interpreting such inferences in relation to management decision processes have been carried out. Not all of the output would be immediately sought by managers, but ideally the information system would seek to anticipate such future needs.

**Process**: The process is the information system proper and will comprise of the procedures and manner in which information is collected, processed, analysed and disseminated. In the next chapter, the functions of a marketing information system will be described and this will then constitute the process.

By definition, the information system is an open system as its collection and dissemination functions, in particular, will necessitate it to have numerous interfaces with its environment, both within and without the larger company system. Hence a control unit, information system management, is inherent in every stage of the process. The tasks of the control unit would be to aid in identifying data or information needs of information system users and to make adequate provisions for data/information storage and dissemination.

**Feedback**: In an information systems context, feedback is the communication of the reactions of information users or user units back to the input for the purpose of adjusting inputs (e.g. updating or dumping data files). The feedback then is an appraisal of how well information needs have been
matched with the information supplied. Devices for generating such feedbacks can range from formal audits of information needs and supply on a regular or sporadic basis to informal suggestions by both users and information system management.

A high degree of feedback is necessary to retain effectiveness, thus implying the maintenance of communicative links with users. Correspondingly, users must receive enough information on their particular area of responsibility to decide whether any vital element is not being sensed or whether the wrong variable is being measured.

Constraints: These are factors within and without the larger company system. Examples are company policies, government laws, difficulty of securing external information (e.g. difficulty of obtaining co-operation of respondents in field surveys), company financial condition. The last-named factor has obviously an important bearing on the information system's ability to develop in terms of its staff, machines, and procedures.
CHAPTER IV

MARKETING INFORMATION SYSTEMS: PROCESS, ORGANIZATIONAL LOCATION, OPERATING MODEL AND PROBLEMS

No normative information system can be prescribed to accommodate the needs of all firms due to factors such as differing information needs, management styles, organizational structures, etc. The following discussion will therefore be based on significant generalized concepts that have emerged thus far in the area of Marketing Information Systems (MIS).

PROCESS

The process of a marketing information system can be described in terms of its functions. An MIS has been defined as:

...a structured, interacting complex of persons, machines and procedures designed to generate an orderly flow of pertinent information, collected from both intra- and extra-firm sources, for use as the bases for decision-making in specified responsibility areas in marketing management.\(^1\)

Thus the MIS process acts as the link between sources of information and users of the information.

FIGURE VII

ROLE OF MIS

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In effect, the MIS then transforms data into pertinent information. The system must thus be goal-oriented i.e. its functions must be designed to meet the needs of users.

Sources: Generally, sources can be classified as:

1. Intra-firm e.g. accounting, production, sales departments.
2. Extra-firm e.g. consumers, channel members, government bodies, general business media.

Users: Marketing management such as the advertising, sales force, distribution managers or committees such as the long-range planning group or top-level executive committees.

Conceptually, the MIS process can now be described in terms of its functions of collecting, processing, analysing and disseminating information. P. Kotler has developed a diagram of the functional classifications and sub-classifications. This study will utilize his work but with some modifications.

FIGURE VIII

FUNCTIONS IN MIS PROCESS

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>COLLECTION</th>
<th>PROCESSING</th>
<th>ANALYSIS</th>
<th>DISSEMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SEARCH</td>
<td>ABSTRACTION</td>
<td>EVALUATION</td>
<td>MANUAL</td>
</tr>
<tr>
<td></td>
<td>SCANNING</td>
<td>INDEXING</td>
<td>STATISTICAL</td>
<td>MECHANICAL</td>
</tr>
<tr>
<td></td>
<td>RETRIEVAL</td>
<td>MAINTENANCE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Kotler showed a schematic relating the various sub-functions together in an ostensibly normative work-flow. However, all that is postulated here is that information goes through some collecting, processing, analysis and dissemination function and that it not be necessary for all functions to be centralized within one formal department.

**Collection**: Collection refers to the process of developing or locating information requested or needed by administrators. This can be subdivided into three functions depending on the nature of the input into the process:

1. The first sub-function can be termed the search process, which is energized by requests for specific information. This can concern anything ranging from information already available to requests for field surveys. If it is available in the data files, it is retrieved and disseminated; if unavailable, the collector may have to approach external sources (e.g. other company subsystem data banks, published literature) for aid.

2. The second sub-function is that of scanning for unsolicited marketing information. Sources may be overt or covert, ranging from government bulletins, trade journals, magazines, company personnel (such as salesmen and public relations personnel). Such a centralized function saves managerial time as executives often display overlapping information needs and individual collection on their part results in duplication of effort and a misallocation of managerial efforts.

3. The third sub-function is retrieval, whereby stored information is located efficiently. This efficiency is related to the
system's incorporation of business machines such as computers, display consoles, disc storage tapes, microfilms and to the suitability of its chosen indexing methods.

**Processing:** Processing refers to the function of inputting value-added to the information secured. This can be discerned as involving three major sub-functions:

1. Firstly, abstraction refers to the paring down of otherwise lengthy information into relevant and pertinent form. This necessitates a proper editing procedure to ensure that no necessary information is omitted. Abstracts may describe only the original articles in brief and provide the decision-maker with a basis for deciding whether to see the original; or it may be analytical and critical and contain all the important aspects of the original. The subject matter and management needs will determine the abstract form. It is thus necessary that abstraction be done by one familiar with the subject matter.

2. Indexing is the process of devising indices that will facilitate efficient classification of the information for storage and retrieval purposes. Regardless of the classification system used, it should be adaptable to allow for modification reflecting the company's developing interests and it should be user-oriented to aid a self-service information search. Typically, this is a professional task and ideally, any piece of information should be classified under several headings to ensure
widespread exposure and linkage with any other related pieces of information.

3. Maintenance of data banks can be further subdivided into two categories—physical maintenance and currentness of material. Physical maintenance refers to the task of ensuring that the information storage structures are in good quality. For example, binding articles and reports in hard covers, microfilming are two methods used in the process of physical maintenance. Currentness of materials refers to the task of ensuring the temporal quality of the information. Functionally, it is then the task of revising, updating and purging the data bank. This could be done after periodic, formal information requirement and usefulness of information supplied audits or after informal suggestions by both users and information system management.

Analysis: Analysis refers to the task of manipulating raw data into information. Conceptually, analysis can be performed at two levels which shall be termed evaluation and statistical analysis.

For essentially non-quantitative data, evaluation is an analysis regarding the reliability, validity and relevancy of information and/or source. This has some import for decision-making as managers then have some idea of the credence of information.

For quantitative data, statistical analysis would involve the usage of mathematical techniques borrowed from statistics, operation research and econometrics. Such techniques could be used for formulate problems and generate solutions on the basis of variables and parameters supplied
Dissemination: Dissemination refers to the task of transmitting the processed and/or analysed information to the users. Devices to disseminate information may range from informal discussions to regular reports to display consoles and computer print-outs.

As a system collects a store of information, it should be recorded and published in a list or bulletin, with a frequency depending on the amount of information collected. Automatic routing of particular journals and magazines to users is another device; and at a more sophisticated level, some form of selective information dissemination could be employed, whereby a user's information needs are matched against the new acquisition and a selective listing sent to him. Additionally, the system should also keep users informed of recent materials in their specific fields, which though not in the company's data banks, are available from external sources.

To fulfill the above functions, it is necessary to locate the bulk of the activities in a formalized department to provide for centralization of resources, facilities and to invest formal authority and responsibility in it. Some exceptions may occur when activities may be deemed to be more efficiently done by other departments e.g. statistical analysis by the planning department.

ORGANIZATIONAL LOCATION OF THE MIS

An MIS can be formally represented in the organizational chart by an Information Centre or an Information Services Department. The location is naturally affected by considerations of efficiency and feasibility.
K. Uhl has suggested three possible locations. Two locations lie within the marketing division—the marketing research department and the merchandising department, while the third is a company-wide information office.

1. Location Within the Marketing Division

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Figure IX shows a simplified structure of a typical marketing organization incorporating an Information Centre. There are subjectively seven types of information collected by the Information Centre ranging from field studies to informal, unsolicited information. The centre is basically an expansion of the typical marketing research or merchandising department.

2. Location Outside the Marketing Division

FIGURE X

ORGANIZATION CHART II

PRESIDENT ——— EXECUTIVE COMMITTEE

V-P MARKETING V-P INFORMATION CENTRE

- Marketing Research
- Economic Research
- Market Data
- Administrative Data
- Internal Information
- Reports
- Unsolicited Information

In this structure divisional status is assigned to Information Centre i.e. there is a Vice-President of the Centre on par with other second-echelon executives. He can thus report directly to the President or Executive Committee or to other functional/operating units. This minimizes the risk of information delay or distortion.
Decentralized Firms

In cases where the organization is structured into product departments or where it has regional branches, modifications to the two basic structures above are needed. Each branch/department would have its own data bank which handles information of interest to itself. Care must be taken to avoid duplication of information functions by the various data banks and the central Information Centre. Hence, there must be clear-cut delineations of responsibility areas as to information functions, especially collection. Communication channels must be instituted to facilitate reports from the subsidiary to the parent or from the product departments upwards and to facilitate pertinent information flowing the other way.

Obviously for smaller firms, modifications are necessary too, as the above structures would generally be infeasible due to absence of large-scale economies. In such cases, the marketing research activity may be deemed sufficient.

Operating Model of the MIS

Figure XI on page 40 shows a centralized information centre which can be implemented for firms with a small volume of stored information such that it can be stored in one data bank. The Information Centre is linked to all marketing decision-units by inward-outward information flows. Thus, all users have direct access to all elements of data and there is no redundancy of information. But for most multi-product firms, the volume of information required is generally so large as to make it impractical to store it in one massive data file.
Figure XII on page 41 shows a simplified operating decentralized information system, which could be extended to more complex interrelationships between decision-units and information centres.

If DU I has to initiate a particular decision, it requests of Centre I all the relevant stored information pertaining to the problem area. In the event that Centre I does not have it or has incomplete information, it may request additional information from Centre II. The latter, if unable to supply it, may then request it from DU II. Upon receipt of it, Centre II passes it to Centre I, which in turn relays it to DU I.
Note: Decision-units can be decentralized on a geographical or product basis.

If DU I receives information of which it is unsure as to potential uses or users, it will stream it to Centre I, which validates and evaluates it. If it turns out to be significant information, it either stores it or passes it to Centre II or does both. Centre II would then process the information in the same way as Centre I. If it is found to be relevant, Centre I would either store it or relay it to DU II or do both.

Thus, the information system is a relationship of input-output.
systems. An input from a decision-unit or information centre can either be a request for or supply of information; likewise, an output from either can also be a request for or supply of information.

Problems of Marketing Systems that Affect Information Systems

In practice, the orientation of information systems to marketing needs are beset by problems stemming from the openness of the marketing system. These problems are ultimately reflected in information collection difficulties.

To institute a prompt feedback system in marketing akin to the automated control system in production is extremely difficult. One reason is that distributive channel members are usually composed of independent firms whose information systems may not mesh because of technical reasons. Also, members of channels may represent levels so different as to discourage information transmittal. These are essentially human problems as marketing is essentially a human task.

The high degree of reciprocity between a firm’s marketing process and the environment theoretically implies the MIS monitoring every aspect of the firm’s system dimensions. Practically however, its scope must be selectively narrowed to be proportionate with management’s capacities to digest information. It must thus be narrowed to the search for major changes in the system and environment which necessitates changes in marketing goals and plans. In mechanisms then, where the dimension are relatively stable and change is highly predictable, information needs tend to be stable. In gestalts however, system dimensions are complex and highly unpredictable. This points to the need for a flexible information
system in the sense of being able to update the variables and parameters sensed as dictated by changes in the larger system's dimensions. Such changes would then involve modifications of existing collection, indexing and analytical procedures to accommodate new information needs.

Another problem posed is the difficulty of constructing adequate marketing models, both of executive- and consumer decision processes, on the part of management. A knowledge of the general principles used in executive-decision process is necessary to specify executive information needs. The difficulty arises with less than optimum decision models, which are often hard to articulate explicitly. J. Howard has stated that common theories of consumer behaviour must be held by all executives in order to further define information needs and to establish some hierarchy of information to be collected.

A further so-termed 'human' problem with information systems is the often personal nature of feedback devices such as the company salesman. Except where specifically trained or programmed to report accurately, such information sources tend to be biased.

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CHAPTER V

MONSANTO CANADA LTD: A CASE STUDY

The case study in the following two chapters is based on the information system being implemented in Monsanto Canada Ltd. The objective of these chapters is to analyse the company's system state and its attempts to integrate information flows in the theoretical framework discussed in the preceding chapters.

Monsanto Canada Ltd. is a Canadian-owned company with its headquarters in Montreal. It is a subsystem of the international Monsanto Company complex, which maintains a central headquarters in St. Louis, Missouri. The Canadian company manufactures many basic chemicals, resins and plastic raw materials. It has full control over its internal marketing operations, though inevitably it has numerous linkages with the American entity not least because of its geographical proximity and common technological base.

To the extent that it maintains control over its domain then, this paper will treat Monsanto Canada Ltd. as the system under review, hence defining all larger systems of which it is a part as belonging to the environment.

MONSANTO'S SYSTEM STATE

Ecological Dimension

The system has numerous interactions with the environment of concern to it (i.e. it implies the open nature of Monsanto's system). Firstly, it
interacts with the immediate market environment whom it is serving. As it is basically a supplier of industrial goods to such diverse industries as adhesives, food, plastics and pharmaceuticals, it is then highly linked to the end-product markets of its customers. The demand for Monsanto's industrial products are then ultimately defined by the demand for these end-products. Hence, its environment of concern extends beyond its immediate customers. Similarly, where it produces consumer goods, it would also interact with the final-consumer market.

Secondly, by definition, the American body is external to the system domain and Monsanto's ecological dimension would have to account for this interaction. Major interfaces occur through technological and business information flows, top management contact and through distribution policies (due to geographic proximity).

Domain Dimension

Monsanto is a complex organization in which the domain includes its main manufacturing base in Montreal and secondary manufacturing plants in Toronto, Oakville, Woodbridge, and Vancouver, and sales agencies in other cities. Physical linkage is maintained through a private telephone and main service.

However, to all intents and purposes, effective control of the system domain is resident in the top management hierarchy based in Montreal. They would be the Control Unit ultimately responsible for system movement and direction in the long-run. Thus the domain of concern here is limited to top management. In this context, the effective domain can be represented in surrogate by an organization chart of the principal administrators.
Monsanto has experienced accelerated growth in terms of sales volume, assets, numbers of markets served, new products/raw materials, and research activities. Its structural change over time has thus been complex. Two factors can be discerned as playing important roles in accounting for this complexity.

Firstly, Monsanto is in an industry where technology (e.g. chemical and engineering processes) is all-important and progressing at a rapid pace. There is consequently a need to keep abreast of the latest technological advances for system survival. For such information, it depends largely on research findings emanating from within the system domain itself and from
external sources (e.g. research work by the Government and Universities).

Secondly, the diversity of its consumers and of its own system operations creates a situation where a technological break-through in one area certainly implies a repercussive effect on its entire marketing and related manufacturing processes. The management of these two latter functions thus require a continuous information sensing function to aid them in decision-making i.e. the need for a Information Processor.

The dimensions of the Monsanto system are thus seen to be highly complex and correspondingly, the marketing subsystem is characterized by openness. Feedback loops are needed to conceptually close the system and these can emanate from within its domain and/or ecological dimensions. These feedbacks are to provide information for planning and control decisions, hence presenting marketing management the basis for which to regulate its inputs with operating results or changes in the environment.

Recognizing the diversity and amount of information required, compounded by its many product outputs and their ramifications in the case of industrial goods, Monsanto Canada has recently instituted an Information Processor in an attempt to provide administrative and research personnel with reliable information from a single source. The desirability of a single source stems from the fact that Monsanto management has found it difficult to demarcate marketing and technical information.

Monsanto Information System

The focal point of the information system is the Information Centre which is located in the Process Technology and Engineering Department. Being in a technology-based industry this department has had traditionally well-developed information flows and hence the location of the I.C. there.
Organizationally, the location of the I.C. is thus:

**FIGURE XIV**

**ORGANIZATIONAL LOCATION OF INFORMATION CENTRE**

The I.C. is directly responsible to the Director of Pt and E, a second-echelon executive and member of the executive committee. Top management is thus directly linked to the Information System and in a position to directly receive reliable information. This minimizes information loss, delay and distortion. Similarly, information is also readily available for the decision needs of management at operating levels. An 'open access' principle enables all personnel to use the I.C., though certain information is restricted to a 'need-to-know' basis.

At present, the explicitly stated purposes of the I.C. are:

1. To provide published literature for company use;
2. To make available as needed;
(a) internally published marketing and technical reports
(b) technical data on Monsanto products.

These objectives clearly imply some collection, processing and dissemination functions. However, as of date, the I.C. has not directly incorporated an analysis function. It is presently being performed, where needed, by the Business Management Department and the externally-based Management Information and Systems Department of the American body.

Monsanto's information system, as represented by the I.C., will now be analysed in module form to view the interrelationships of its attributes.

1. **Inputs:** Functionally, the inputs that trigger the system comprise of either specific requests for information or the process of continuous information scanning. These inputs then result in a collection procedure from sources internal and external to the larger system domain.

2. **Outputs:** The goals of the information system (see above) would then be the outputs. Due to the two-fold purposes stated, there are two levels of outputs:

   1. **Regularly disseminated information services** which take the form of publications designed to acquaint personnel with the types and contents of newly-acquired information material. These services can be classified under:

      (a) **Alerting** e.g. a 'Contents Preview' which is a Table-of-contents of new periodicals.

      (b) **Indexes, Catalogs** e.g. a Marketing Reports Index which is an index of all available marketing information on any Monsanto Product.
(See Appendix I for a full list of such services available).

This level of output is designed to maintain current awareness of developments in any marketing/technical area and results in a new input of specific requests for such information.

2. **On-demand information services** which subsumes the function of actual information supply. A request for specific information (e.g. a Marketing report) is met by this service. (See Appendix II for a full list of such services available).

3. **Process**: The process will be described here in terms of the IC functions.

Inputs result in information search and scanning procedures from sources, here classified as:

1. **Internal to the larger company system**
   
   (a) Manufacturing data from the Manufacturing Department.
   
   (b) Technical developments and product information from PT and E.
   
   (c) Accounting and financial data from the Finance Department.
   
   (d) Marketing information from the Marketing Departments.

2. **External to the larger company system**

   (a) Marketing research data from commercial research agencies.
   
   (b) General business information from magazines, periodicals, etc.
   
   (c) Any of the above information from the IC of the St. Louis headquarters.

**Collection** can then be viewed as:

1. **Search** and selection of information. This reflects the judgment of the IC staff and the suggestions and specialized knowledge of company executives, scientists and engineers. It then consists of actually gathering the data or keeping track of information
sources (e.g. literature search service, indexes of reports available in company subsystem data files).

2. **Scanning** of information sources, particularly with respect to external sources. This normally results in regularly-disseminated information e.g. articles in general business magazines are broken down by field of interest and circulated to appropriate managers.

3. **Retrieval** of information. Specific requests for information are handled by retrieval from the IC data bank. In cases where the information is not present, the requesting unit may be referred to the information source.

**Processing**

**Abstraction** of internal information is done by qualified personnel in that particular department (product or functional) which issues the report. These abstracts are then indexed.

**Indexing** of Monsanto technical reports is either by author, report number, job number or by the Co-ordinate Concept Subject Index arranged alphabetically. Indexing of Marketing reports is by key word e.g. AR: Advertising Research, CS: Competitive Study. Requests for marketing reports are usually referred to the issuing department which stores all its reports.

For its scanning function, Monsanto relies on purchased services as indexes to the literature, rather than selecting, abstracting and indexing articles themselves. Reportedly, this approach costs less, provides more flexibility and permits greater access literature than would be available otherwise. It works closely with publishers of abstracting and indexing services to ensure receipt of pertinent information. Services of secondary
journals (e.g. Chemical Abstracts, Engineering Index) enables contact with the large amount of technical literature published and others (e.g. Business Periodicals Index) with general business developments and information.

Maintaining the currentness of information is handled by such purchased services as well as by the suggestions of user units. Physical maintenance range from binding to use of microfilms.

Dissemination

Methods of dissemination, as discerned from the above, are:

1. **Automatic routing** of selective information to appropriate managers.

2. A **self-service** method i.e. direct personal use of the IC data bank.

4. **Feedback**

Feedback for the Monsanto information system is an informal procedure where user units themselves express the usefulness of the disseminated information and suggest other information needs.

5. **Environmental Constraints**

Monsanto Canada's information system has just begun functioning as an entity very recently. Hence, its operations are still being constrained by limitations on finance, physical space, staff, and information storage and retrieval equipment.

The module of the Information System can now be constructed diagramatically, with the IC functions in a generalized work flow form depicted as the process.
To further comprehend the system, the decision process in generating information is shown in flow-chart form in Figure XVI (next page).
The triggering element is the "Information Need" box. This need is referred to the IC. If the information is available from the IC, this leads to retrieval and dissemination. If it is not, a search or scanning activity is started which leads to a query whether the information is obtainable. The negative answer leads to a re-iteration of the search/scanning activity. If the information need is urgent, this may result in formal steps to acquire it, e.g., market research. The affirmative answer leads to the next query of whether the information is obtainable within the company domain, e.g., accounting files, salesmen reports. If it is, a collection and
processing activity takes place ultimately leading to retrieval and dissemination. If it is not, the next query is whether the information is obtainable from an external source e.g. the IC in St. Louis, Government report. A negative answer leads to the search/scanning activity again. If it is obtainable from the external source, it is then collected and processed and finally, retrieved and disseminated. In the case where the external source is the IC, St. Louis, then the sequence from the "External Source" box by-passes the collection and processing procedure, as this would be mere duplication of effort, and go direct for dissemination.
CHAPTER VI

INFORMATION SERVICES FOR MARKETING

This chapter will be based on the attempts by Monsanto marketing management towards solving some key problems in their marketing process through the utilization of information services from the Information Centre. In the course of this, the case study will also highlight some of the ways in which management has utilized the computer in developing information aids.

INFORMATION SERVICES FOR MARKETING

During the marketing planning stage, management can call on a variety of information aids from the Information Centre.

One important pre-requisite of a marketing plan is a reliable sales forecast. On it depends decisions such as budgeting for raw materials, product inventory, promotional expenditures and expansion plans. Though not a typical marketing function, the manner in which sales forecasts are developed provides an excellent example of the benefits derived from the information services combined with the analytical ability of the computer.

For Monsanto, the problem of sales forecasting for their industrial products, in particular, narrows down to ascertaining the rates of growth or decline for the product and the relationship of its demand to general business conditions.

The raw data pertaining to historical demand patterns are usually
obtainable from the accounting data files. However, such data needs to be interpreted and for this purpose, a single computer program has been developed. Once the historical sales data has been obtained, the forecaster then has to elect a particular curve (straight line, semi-log, quadratic etc.) which is suited to the data. After key-punching the data and running the program, an output is generated consisting of information on past sales, both actual and forecasted, and a ten-year extrapolation of the trend curve. Confidence limits are given for each forecasted value and some indication of the chosen curve's goodness of fit is given by the calculated coefficient of determination.

Another significant problem in sales forecasting is the impact of general economic changes on certain 'vulnerable' products. Monsanto's industrial markets are so wide and consequently interlocked with the ultimate market of the end-use of their products, the forecasting problem is thus compounded by the need to forecast appropriate economic indices. To comprehend the relationship between product sales and economic conditions, marketing executives have traced the flow of products through the economy to the point of final consumption. Such reports are indexed as End-use Analysis and available through the Information Centre. These reports contain analyses on consumer goods such as refrigerators, clothing, rugs, whose demand ultimately define the demand for Monsanto products. For each product, the list of end-uses is instrumental in deciding which economic activity has a bearing on its sales. By using a regression program with historical data on product sales and the appropriate indices, parameters are developed for these indices. The regression equation is then tested against past sales data. If it proves satisfactory, Monsanto then either purchases (from commercial research firms)
or develops forecasts for the selected indices and comes up with a forecast for its product. Usually, the forecast is then refined to incorporate managerial expectations of unusual situations during the forecasted period e.g. raw material shortage, major price change.

Other information aids available during the stage of goal-formulation and strategy for any particular product include reports on competitors, the particular market involved and the degree of success of past company market strategy. These reports are filed under the Marketing Reports Index and the departments responsible for their compilation are also responsible for storing and loaning them out when requested.

For example, a thorough analysis of Monsanto's competition in any product or market area, with respect to their profitability, return-on-investment, sales methods, prices, etc., is available in the Competitive Study Report. This has been compiled by various groups, such as Company salesmen, the Business Management Department and outside commercial research firms often providing a wealth of information in this area.

The Market Study Report plays a large role in defining market boundaries and its general characteristics and trends. It contains a complete analysis covering all phases of a market and based on comprehensive literature search, internal company interviews and formal field interviews or surveys. The information presented pertains to market statistics, market requirement, current raw material used, market characteristics, major producers of competing and using products, industry terms and definition. Each report generally includes a summary and conclusions. In addition it also presents recommendations for actions, usually of a long-term nature. These recommendations, provide a concrete foundation for building upon the
short-term marketing programs. Management has reported that together with the End-Use Analysis Report, these information materials often result in identifying new market opportunities and maintaining a current awareness of individual market developments.

In addition, a Market Strategy document is available which analyses the market strategy for a particular product or product line. Information content pertains to size, growth, character, competition and customers of the market involved. The degree of success of past market strategies in relation to the stated goals gives management a more evaluated basis to decide on future goals and strategy.

During this earlier phase of developing a marketing plan, management also calls for information from other company subsystems, notably from the accounting department. The Information Centre keeps track of all available report forms in the accounting files. For example, sales figures are disseminated routinely which shows a breakdown by geographic areas, types of products, classes of industries making the purchases, salesmen receiving credit and individual customers. Such information is pertinent to decisions on allocation of marketing efforts between geographic areas, products, or markets, e.g. a decision that a particular market may require more personal selling effort, less advertising or more standardized product quality with more efficient delivery than might another product market. Further, a breakdown of sales figures into times of sales also provides management with a basis for analysing seasonal variations in demand (e.g. by the O/MA method) and its long-term growth potential.

At the operative level of the marketing process, information services are available to alleviate certain problems in the advertising, distribution
and pricing areas.

In the area of designing advertisements, management faces the problem of adequate measures of advertising effectiveness. Monsanto marketing executives' theory of consumer behaviour include a premise that most advertisements are designed to increase sales in some way, though not necessarily to perform the complete sales task. But often due to lack of clearly defined advertising goals, executives generally accept that indirect measures such as readership scores are adequate proxy measurements. These readership scores are, in turn, some function of the mechanical features of an ad e.g. illustration size, copy length, location of the ad.

Information relating to such features are obtainable from the larger Information Centre in St. Louis. The services of outside commercial research firms (e.g. Industrial Advertising Research Institute) are purchased and these take the form of tabulated data covering several thousand ads. For each ad, there is a readership score and a description in terms of about seventy variables. Using a regression program, information has been generated on which mechanical features of an ad are important e.g. illustration size is held constant and its degree of relationship to readership figures determined. In this manner, Monsanto advertising personnel are able to design advertisements more concretely in terms of its mechanical features.

Distribution of industrial products to user industries often necessitate high transportation expenditures. Thus since freight costs comprise a high percentage of total distribution costs, budgeting for such costs is an important area for marketing management consideration. The control of distribution costs involves making comparisons between actual costs and costs that might have been incurred if other transportation modes had been
utilised. Historical data on these are generally obtainable from the accounting files. These comparisons on a large scale provide distribution management with a sound basis in negotiating equitable freight rates with transportation companies.

It is towards such an end that the company's computers have been instructed on the calculation of freight costs. During actual operations, freight costs are thus calculated rapidly for any sales order. The computer is also instructed to calculate costs of alternative transportation modes and to select the lowest cost subject to constraints such as maximum allowable time for distribution.

Marketing of industrial goods often involve long-term contracts with buyers. A specific pricing problem which confronts management here is that of losses due to monetary inflation. Since contracts normally cover several years, the probability of this is significantly higher. To hedge against this, contracts incorporate price escalation clauses. These clauses are either tied to a single economic index (e.g. cost of living index) or to several indices deemed to be appropriate measures of price fluctuations (e.g. cost of labour, cost of raw materials as well as the more general cost of living index).

The problem then is to identify price changes as each index changes over time. Forecasts for such economic changes are developed by commercial research agencies (e.g. Predicasts) and obtainable from the Information Centre. If three such indices are used for a five-year contract there could conceivably be, for example, $35$ different price combinations to consider. The main problem however is the probability of the indices taking on values leading to extreme high or low prices which might not be compatible with
company price policies. Again, in such lengthy calculations, the computer has been utilised. If the probability of extreme prices are high, management then can alter the index or combination of indices prior to contract formulation.
The principal purpose of this study has been to find a useful framework for classifying generalizations about marketing information systems. The approach found most appropriate was the general systems concept. This approach leads to an analysis of the functional interrelationships of any system by examining its inputs, outputs, process, feedbacks and constraints. These elements enable the identification of the interrelationships with an on-going system process and the delineation of system boundaries.

Initially, the need for marketing information in a timely and pertinent form was assumed. Using the general systems concept, a generalized analysis of marketing systems was made in terms of their ecological, domain and dynamic dimensions. The complexity of these dimensions are often accompanied by incomplete information concerning each dimension so that marketing management has to deal with systems under conditions of uncertainty.

Where marketing research has failed to provide effective, continuous information feedback due to its particularistic orientation, the case for an information services department gains strength.

Taking the information system as the system of concern, the module structure depicted its role as an information processor which would ideally enable marketing management to carry out its strategic planning and management control activities more effectively.
Conceptually, inputs into the information system are the data reflecting information needs of management, and outputs the supplied information. The system proper is a structured, interacting complex of humans, procedures and hardware designed to manage information. The process then consists of tapping various sources of information and of processing, analysing and disseminating the information. Feedback is then to ensure that the information supplied reflects information needs as consistently as possible. Constraints are the various factors which impinge on the system's capacity to generate 'complete' information.

A fundamental theme of the marketing information systems considerations is a formal placement of the MIS within the organizational structure. Within such a formal location, the operating model of the information system is then seen to function. Its operations can be either of the centralized or decentralized type. Both are essentially networks of input-output relationships with other company subsystems.

No attempt was made to discuss the hardware aspect of the system in spite of their being useful and often necessary tools. The importance of information retrieval machines and computers can be seen in that only with the recent advances in hardware technology was there any serious thought given to managing marketing information. Important though this aspect may be, information systems analysis should emphasize on how the organization collects, processes and communicates information to aid decision-making. This emphasis on the procedural and managerial aspects was then the guiding principle followed in the case study.

Using such an analytical framework as outlined above, Monsanto's information system can be seen as a formally located entity with numerous
environmental interfaces both within and without the larger company system. The IC is the main data storage centre with input-output linkages to other company subsystems. These other subsystems maintain their own databanks too. Hence the system is of the decentralized type, with a larger central data bank supported by smaller data banks. Where needed, information from these intra-company sources (principally the accounting subsystem) have been extracted and disseminated to the appropriate managers either for specific decisions or on a regular basis. It is then the responsibility of the IC to make potential users aware of what information is available and where, e.g. by the dissemination of indexes, catalogs and by the provision of a monitor-consulting service (see Appendices I and II).

The principal conclusion from the case study is that the conceptual framework can only describe an information system in generalities. On the basis of the Monsanto case, it was found that an information system will adopt procedures and operating principles unique to itself. The features of the case study sheds more light on information system development and the aspects discussed below point out that any information system must develop within the firm's needs, constraints and advantages.

For example, the location of the IC is an intermediary step between the two structures suggested in the theory. It has been located outside the marketing division but no as a separate department of its own. The Research Technology and Engineering Department has had traditionally well-developed information flows. Hence the desirability of locating the IC in such a favourable information climate.

Though the IC is not of full departmental status at present, being under the responsibility of a second-echelon executive ensures a
minimum of information loss, distortion or delay to top and middle management. Efficient information transmission is ensured through the Director of RT and E who is involved in both Executive Committee work and in line management. Furthermore the open access principle aids in the dissemination of information to lower management. For all users, the circulation of acquisition and holding indexes provides a constant awareness of information available. Thus in the early stages of development, the successful location of the system depends on the existing state of information flows and on the dissemination methods adopted.

The decision to locate both marketing and technical information in the IC stemmed from management realizing the inseparability of both to the marketing process--a move consistent with the marketing concept. However, there is no strong emphasis on establishing one single, huge data bank. This can be deduced from the existence of subsystem data banks and of the larger, more developed IC in St. Louis which provides a reservoir of information to be drawn upon. This decentralized set-up reduces duplication of information functions to a large extent. A single, huge data bank raises problems of adequate indexing and management methods and hence in practice, seems too complicated especially for large volumes of information. It appears then that decentralized information systems may be more feasible for large firms.

Another significant feature is that not all the functions raised in the theory are incorporated in the IC. A notable exception is the absence of an analytical function. This is due to two factors. Sources of information such as hired research agencies and intra-company technical researchers are usually competent enough to forego reliability or verification tests.
Where analysis of a mathematical nature is needed, this is done by company personnel with the experience and expertise in computer and mathematical work. Clearly this is a form of benefitting from division of labour. Management has not expressed any intention to coalesce the IC and analytical activity, holding that the latter is being done more economically and speedily outside the IC. It is inferred from this that information systems need not depend on a single department but on the ability to conceptualize and manage these different functions as parts of a single entity.

A drawback in Monsanto's information system seems to be that no formal articulation of executive-decision processes or audits of information supplied have been initiated. Information system development depends on the ability to specify requirements for information, determine sources of information and then the integration of requirements with sources. Information sources present no particular problem, but the specification of information needs involves the ascertainment of management's perception of its own and of customer decision processes. For instance, questions such as "Are customers greatly affected by advertising?" and "Do price policies depend on industry price leaders?" are determinants of management models and consequently the types of information to be collected.

However, the answers to such questions can be seen to be derived from an informational base itself. Thus there exists a high degree of interrelationship between data bank content and management models. Each develops in a symbiotic relationship with one another. In Monsanto's case, the informal audits used are effective only to the extent that they are accurate reflections of information needs. As has been contended, intuitive decision models are difficult to express and in such cases information
needs tend to be obscured. It is suggested that a formal inquiry into
decision processes is predicate to maintaining effective system feedbacks
and consequently, system development.

The operating principle of using purchased services, rather than
selecting, abstracting and indexing articles themselves has the advantages
of costing less, providing more flexibility and permitting greater access
to the literature than normally available. This however means that the
system boundaries have been extended beyond the organization itself. To a
certain extent, such externally-based subsystems may be a unpredictable
part of the domain as they do not inherently subscribe to the goals of
the information system. This problem of control has been circumvented to a
large extent by working closely with the publishers of such services to
see that they provide the kind of services Monsanto needs.

In the discussion on information utilization, it was noticeable that
management still makes the final decision and more importantly, supplies
creativity and initiative. Examples of this can be seen in the refinement
of sales forecasts, identification of new markets, and negotiation of
freight rates (see Chapter Six). Thus the information system is still far
short of making the actual decision, particularly in strategic planning
and management control. This also implies that information systems are
useful only when accompanied by a corresponding management ability to
utilize the information effectively.

Finally, on the question of benefits, Monsanto management has identi-
fied several benefits which have accrued thus far:

1. Control and reduction of costs.
2. Ability to disseminate more information from a single source.
3. Ability to specialize in terms of staff and facilities.
4. Increased flexibility to meet changing needs.
5. Ability to exert more influence on publishers and other information suppliers.

Such benefits are mainly of an intangible nature and it is difficult to place a financial value on them, excepting for cost reductions. But the justification for information systems are not based solely on cost reductions. The system's goal orientation implies that benefits to users are equally if not more important.

For management, benefits come in the form of non-duplication of information collection efforts and a ready access to reliable information. J. Forrester has shown how various delays in information processing and dissemination lead to marketing decisions that often accentuate production fluctuations beyond those caused by forecasting errors and resource immobilities (J. Forrester 1959, p. 100-110).

While not intending to go into specifics, it is suggested that any cost-benefit analysis of information systems would have to reflect both tangible and intangible benefits. In the area of planning and control, the problem of estimating benefits is compounded as they tend to be reaped only in the long-run.

For an essentially industrial firm, the present rate of advancement in science and technology can mean both constant opportunities for new markets and products and a faster rate of obsolescence both of the company and its products.

Information on scientific research, as reported in various technical periodicals and journals, flow to the IC whose responsibility it is to alert
the appropriate managers of its availability. Consequently such information often finds its way into strategic planning decisions e.g. to enter a new market. Information relating to present market characteristics and new competitive products are often reflected in the management control process e.g. allocation of advertising budgets.

In addition, a bank of such information collected over the years often provides a basis for learning more about the gestalts which such large-scale business systems inevitably are. For example, information collected over long periods of time may enable trends to be seen more clearly or raise warning signals of pitfalls to avoid.

It is felt that the benefits of centralizing information services will pay off particularly in the long-run and only when accompanied by the ability of managers to utilize the information generated successfully. In conclusion, while not suggested as the panacea of all management ills, an effective marketing information system will provide timely, reliable and pertinent information to give a sounder foundation to marketing management decisions.
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B. PERIODICALS, MONOGRAPHS, ETC.


APPENDICES
APPENDIX I

Regularly disseminated information services

Alerting:

- Contents Preview (Table-of-contents of new periodicals)
- Patents Preview
- Library Bulletin (announcing new books, etc.)
- Pamphlet List (lists new pamphlets each month)
- Central Reports Acquisition List (monthly circulation)
- Technical Report Abstracts (new Monsanto reports)
- Sample Research Centre Data Sheets (new compounds for screening)

Indexes, catalogs:

- Book Catalog (printed author, title and subject indexes)
- Monsanto List of Serials (holdings of 22 Monsanto libraries)
- Technical Reports Index
- Sample Research Centre Molecular Index (dealing with over 70,000 chemical compounds)
- Marketing Reports Index (revised annually with supplements available semi-annually)
- Translations, Reprints, Dissertations Indexes
- Directories Index (dealing with several hundred directories to manufacturers, associations, products, education, etc. and is continuously updated)
APPENDIX II

On-demand information services:

Interlibrary loans (obtain information not available in IC by interlibrary loan or special purchase)
Photocopies of articles, reports, etc.
Reference questions (IC offers reference and search service for company problems)
Literature searches
  Technical literature
  Business literature
  Patents
  Monsanto reports, Sample Research Centre files
Translations (includes translations acquired by research and patents departments)
Obtain government reports, specifications, dissertations
Loans of materials in open access collection
Monitor-consulting
  Records retention, microfilming
  Personal/departmental files and indexes
  Referrals to outside sources
Withdraw samples from Sample Research Centre storage and send out for screening
Company profiles (special compilations of published information about specific companies made on request)