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I am submitting herewith a dissertation written by Stephen Arthur LeMay entitled "The Design, Organization, and Methods of Strategic Information Systems: A Study of the Motor Carrier Industry."

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THE DESIGN, ORGANIZATION, AND METHODS OF STRATEGIC INFORMATION SYSTEMS:
A STUDY OF THE MOTOR CARRIER INDUSTRY

A Dissertation
Presented for the
Doctor of Business Administration
Degree
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ABSTRACT

Because the motor carrier industry has undergone traumatic change in the last four years, deregulation, supply shocks, and other factors have brought about major changes in the manner in which carriers interact with their environment. The purpose of the research was to explore the way in which firms gathered and used information for strategic decisions, and to prescribe means for developing strategic information systems in the industry.

Through interviews with 62 managers and executives in 22 firms, six areas were explored: a) the scanning areas important to the managers; b) the variables used in scanning; c) the satisfaction of the interviewees with existing systems; d) the software presently being used for strategy analysis; e) the integration of the computer into the strategic process; and f) the processes presently in use. Other areas were examined incidentally to these areas, including sources, key decisions, and the classification of computerized information systems.

The results were analyzed using qualitative and simple quantitative tables, which provided a foundation for creating two models. The first gives explicit guidelines for developing strategic decision profiles of customers, competitors, government, and the resources of the firm. The second places the strategic information system in the context of the environment and of the strategic decision process, including the role of the strategic informant.

For the industry, this research implies that more attention must be given to gathering strategic information, especially about customers. Many firms in the industry will have to reorganize to accommodate the increasing need for information processing through technological and human means.

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CHAPTER 1

STRATEGIC INFORMATION SYSTEMS IN THE MOTOR CARRIER INDUSTRY

Introduction

Motor carriers now live in a new environment, which demands new ways of managing firms in the industry. The survivors and the beneficiaries of the turmoil created by such factors as deregulation and the economic downturn must battle one another in a world that neither operates according to the old rules nor responds to many of the management techniques of the past. Both the protections and the restrictions of regulation have disappeared, leaving firms open to an uncertain and often hostile environment. After 45 years of relative stability, motor carriers must learn to live with rapid change.

Strategic management processes and the information which drives them meant little to motor carriers under regulation. Probably because of the protective influences of the regulatory process, firms which did not plan fared as well as firms which did (Kallman and Shapiro, 1978). Given this history, deregulation caught many firms unprepared for the demands of strategy making, or for gathering the information on which strategy formation depends. Yet the prosperity of firms in this tumult hinges on the effectiveness of these processes. The question is: Where do motor carrier managers get information for strategy making in this new environment?

The remainder of this chapter gives an overview of the literature relating to strategic information systems in the motor carrier industry, discusses the purpose and significance of this research, and outlines the other chapters of the dissertation.

An Overview of the Literature

Little literature bearing on the topic of strategic information exists. Still less may be found on the topic of strategic information systems in the motor carrier industry. Consequently, the theoretical background for this research comes largely from strategic management and information systems literature.

Strategic Information Systems Literature

Theorists from both management and information systems have written on the topic, but no previous empirical research has been found. Although conceptual frameworks of the field range from a set of prescribed linear programming models (Holloway and Pearce, 1978) to a stepwise process for matching strategic information subsystems to segments of the environment (King and Cleland, 1978), no definitive paradigm for research was apparent. Three dimensions of the concept were consistently present--the strategic planning process, the organizational environment, and the design of the system itself (Henderson and Nutt, 1978; King and Cleland, 1978).

Strategic Management Literature

Strategic management theory and research offer a series of steps which managers either do or should follow to create strategies formally. The effectiveness of these steps is well supported by research (Armstrong, 1982; Glueck, 1980), but no one model is distinguished from the multitude. Assessing the perceived usefulness and content of four models of the strategic management process, transportation managers gave the highest overall rating to Hodgetts and Wortman (Boyd and Summers, 1982). This model uses analysis of problems and opportunities, formulation of appropriate solutions and responses, implementation of solutions and responses, interpretation of policies and operations, evaluation of policies and operations, and integration of actions and interactions as component steps (Hodgetts and Wortman, 1980). Because of its content, clarity, and simplicity, this model will be relied upon frequently in the course of this project.

Techniques for Scanning the Environment

The demand for information arises at each step in the strategic management process, but the literature has given the most attention to scanning the environment, a part of the analysis stage. On one hand, the techniques for scanning the external environment comprised the second most frequently published type of article, according to a survey of 12 journals in the field (Wortman, 1983). Among the techniques for factor identification, variable isolation,

and segment surveillance are computer data bases, illicit human intelligence, and intuition (Reed, 1977-78; Cleland and King, 1978). On the other hand, the internal environment has been neglected (Hofer, 1977; Henry, 1981). In the only empirical work which looked at managers' views of the internal strengths and weaknesses, Stevenson (1976) found that the judgment of strengths and weaknesses depended upon both historical and goal-oriented criteria, but even more on whether the evaluation could be integrated into the individual manager's planning process.

Nature of the Environment

Strategic management researchers have also categorized the environment, either by its behavior or by arbitrary, intuitive segments. Rate of change, tendency for positive and negative elements to cling together, and complexity are examined under behavior (Emery and Trist, 1973), while the intuitive segmentation of the environment usually serves an analytical purpose, breaking the overall environment into categories like market/customer, government/legal, or research/technological (Glueck, 1980). These categories are frequently pedagogical, generally convenient, and sometimes useful.

Information Systems Literature

The study of information systems grew up around the use, installation, and design of large computer systems. Although the conceptual frameworks for study in the field include a much broader scope, the majority of the research is still on the single variable,

information system content problem. New software packages and other physical aspects of information systems still make up the largest share of dissertations and published literature in the field (Ives et al., 1980).

Conceptual Frameworks for Information Systems

Included in the frameworks for information system research are variables relating to organizational environments, information system processes, and information systems content. Efficiency (Chervany et al., 1971), behavioral (Lucas, 1975; Mason and Mitroff, 1974), and content (Gorry and Scott Morton, 1971) perspectives have all been taken in the development of these structures. Still too new to have supported significant streams of research are comprehensive frameworks presented by Ives et al. (1980) and Ein-Dor and Segev (1981).

Problems created by the use of computers in organizations, such as low system use, irrelevant output, and poor technician-manager communication, have prompted a series of behavioral studies on why information systems fail (Lucas, 1975), and also some alterations of the concept of the management information system.

Decision support systems (DSS) may represent an evolutionary step in information systems theory, or a definitional problem in the field (Blanning, 1983). DSS offers some solutions to management information systems (MIS) problems. It brings the manager closer to the computer, analytical tools, and data bases. Additionally, it allows the manager to reduce the backlog of new

applications and gives the decision-maker greater control over analysis (Keen and Scott Morton, 1978).

The information systems literature pays little attention to strategic information systems, although the decision support literature and Lucas' (1978) research framework offer the possibility and even the necessity for such research to help broaden the empirical foundation of the field (Alter, 1980).

Purpose of the Research

The central assumption of this research is that the better understanding managers have of their organizations and the changing environment, the more likely they are to devise successful strategies for their firms. The common principles of strategic information system design, organization, and methodology revealed in this research establish a basis on which motor carriers can develop an information component to support strategy development and implementation.

The purpose of this research is two-fold: (a) to explore how motor carrier managers currently obtain the information they use to develop their strategies; and (b) to develop a prescriptive model to help motor carrier managers include strategic information systems (SIS) in the design of their information system.

Significance of the Research

The results of this project should contribute to the academic study of information systems and strategic management, as well as

provide motor carrier managers with a guide to strategic information systems design. Although the strategic information system links the strategic management process and the environments of the organization, this link is without a current empirical foundation based upon the study of a large number of firms. Concentrating on the motor carrier industry, this work should provide a springboard for strategic information systems research in other industries.

Since information systems literature lacks a study of a large number of firms on the interrelationships between environmental, process, and content variables (Ives, et al., 1980), this study is the first of its kind, thus filling a major gap in one of the major bodies of background literature.

Placing this research within the broader context of the literature and industry practice, motor carrier managers should have a reliable means for evaluating their own information and strategic planning systems.

In addition, this work reexamines strategic information systems in the light of the whole strategic management process, thus making a contribution to that theoretical body.

Organization of the Remaining Chapters

The remainder of this dissertation is arranged as follows: (a) Chapter 2 reviews the literature on information systems and strategic management as it relates to this project; (b) Chapter 3 details the methods used in the research; (c) Chapter 4 discusses the sample characteristics, and field experiences with the

methodology; (d) Chapter 5 answers the first two research questions, on scanning areas and variables; (e) Chapter 6 deals with the systems strategists' satisfaction with current systems and the integration of the computer; (f) Chapter 7 examines the usefulness of software in strategic information systems and the overall process; and Chapter 8 summarizes the research, draws its conclusions in the form of a comprehensive model, and explores directions for future research.

CHAPTER 2

LITERATURE REVIEW

Introduction

So many fields have an interest in the study of information and information systems in organizations that careful limits had to be drawn to keep the literature review from covering the whole of human existence. While English, journalism, history, psychology, and engineering, among other disciplines, stake claims to the study of information systems and flows within organizations, for the purposes of this project the search was confined to the fields of information systems and strategic management, with an acknowledgement to the economist who helped explain the business meaning of information.

From the strategic management literature, work on environmental scanning, analysis, strategic information systems, and the strategic management process contributed either directly or indirectly to the background of this project. Conceptual frameworks, individual difference studies, strategic information systems, management information systems, and decision support systems work came from the information systems literature.

The literature was reviewed topically, under the following headings: (a) the nature of information; (b) the value of information; (c) MIS, DSS, SIS definitions; (d) information research streams; (d) SIS and strategic management; and (f) MIS and DSS in motor

carriers. A comprehensive model of strategic information systems is developed and discussed at the end of the chapter.

The Nature of Information

In popular usage and in some dictionary meanings, "data" and "information" are synonymous. Some theorists in the field, such as Keen and Scott Morton (1978), found the distinction difficult to make and felt that much theoretical work was still required to establish the basis of difference. Other theorists have found the distinctions to be both significant and clear.

In the literature, the difference between the two terms depended upon the decision-maker and the decision. Radford (1978) distinguished between recorded experience (data) and recorded experience that is or can be used in decision making (information). Similarly, Tricker and Boland (1982) saw data becoming information only after it had been interpreted by an individual. As for strategic information, it was data evaluated with a specific and identifiable use in the strategic planning process, while data were unevaluated symbols (King and Cleland, 1978). In effect, the presence of information was determined by external factors, making the phenomenon highly ambiguous and idiosyncratic in theory, if not in practice (Tricker and Boland, 1982).

The Value of Information

Stigler (1961) pointed out that the more significant the decision, the more thorough the search for information; the more

frequently the decisions occur, the greater the effect of information; and the broader the potential market, the greater the cost of information and the greater the potential value.

These postulates have been incorporated into the study of imperfect markets, price theory, and other subdisciplines of economics. Also arising from these origins are recent works on the economic analysis of advertising and consumer behavior (Mitchell, 1978; Tuerck, 1978). The influence of this concept led back to the information systems and strategic management literature.

This literature suggested that the value of information was dependent upon how it was used (Ein-Dor and Segev, 1978) and on its ability to reduce uncertainty (King and Cleland, 1978). That a symbol possesses value at all may make it information. Tricker and Boland (1981) stated that information has value, while data have only costs.

Firms behave as though information has value. Assuming that managers of firms are rational, it must. Otherwise, owners of those firms would not be willing to bear the costs of data gathering associated with that value (Stigler, 1971; King and Epstein, 1976). As it stands, firms actively seek that value through expensive management information, decision support, and strategic information systems. These systems are discussed in the sections which follow.

Management Information Systems, Decision Support Systems,
and Strategic Information Systems Defined

The distinction between the three types of information systems was not clear in the literature because of some of the same problems which were encountered in distinguishing data from information. A pattern of distinct systems did emerge, but many areas of uncertainty remained.

Management Information Systems

There were two types of definitions of management information systems (MIS): (a) those which emphasize the physical realization of the system; and (b) those which stress the functions of the system within the organization (Ein-Dor and Segev, 1981).

Moravec's (1969) definition was of the first type:

An information system may be defined as the procedures, methodologies, organization, software, and hardware elements needed to insert and retrieve selected data as required for operating and managing a company.

Kennevan's (1970) definition was an example of the second type:

[MIS is a] formal method of making available to management the accurate and timely information necessary to facilitate the decision making process and enable the organization's planning, control, and operational functions to be carried out effectively.

Finally, Davis (1974) incorporated elements of both types:

A management information system is an integrated man-made system for providing information to support operations, management, and decision-making functions in the organization. The system utilizes computer hardware and software, manual procedures, management decision models, and a data base.

The first type of definition reflected the literature and practice in the field. Much was written about management information systems by computer scientists who identified the MIS as almost synonymous with the computer (Keen and Scott Morton, 1978). Consequently, work was published under the heading of MIS which had little to do with management, but rather with the replacement of clerks and the conduct of transactions (Ives et al., 1980; King and Cleland, 1978; Blanning, 1983). Perhaps it was the non-managerial orientation of this work that brought about the development of the decision support concept.

Decision Support Systems

It is difficult to find definitions of decision support systems (DSS) in the literature, perhaps because there is no easy way to distinguish DSS from MIS as functionally defined. The broadest definitions of MIS swallow all of the distinct meaning of DSS.

Keen and Scott Morton and Keen have offered two definitions:

(DSS implies) a conversational, interactive computer system with access through some form of terminal to the analytical power, models, and data base held in the machine (Keen and Scott Morton, 1978).

DSS is about the use of computers in management (Keen, 1980).

Keen and Scott Morton spent three pages qualifying and explaining their definition, only to arrive at a point little different from Davis' (1974) definition of MIS. The second definition was broad, but it does reflect the focus of DSS on the computer.

Finally, King (1983) defined DSS as follows:

DSS is an interactive computer based system that utilizes decision models, gives users easy access to a significant data base, and provides various display possibilities.

If this definition were to be classified according to the scheme already offered for MIS, it would clearly belong to the category that emphasizes physical realization, which is consistent with the DSS literature's stress on computers.

Strategic Information Systems

No straight forward definitions of strategic information systems (SIS) existed in the literature. While it was suggested that SIS would be the center of strategic management literature in the next decade (Stiles, 1981), no theorist explained what SIS was. Radford (1978) said that it focused on the external environment; Stiles (1981) suggested that it concentrated on the question: where do managers get information to make good decisions? All of this circumvented the issue of definition.

Some widely dispersed passages from King and Cleland (1978) approached a definition:

. . .a way of identifying, collecting, and analyzing a wide conglomeration of data that can have an effect on (the firm's) future . . . a system for disseminating information to those who need to use it . . . that produces accurate and reliable information for strategic decision making.

These statements contained many of the elements that might have been included in a complete definition of an SIS, but fell short of it, both in presentation and in content. As far as the literature was concerned, SIS was even less well defined than DSS.

Comparison of Concepts

Based on this review, it was difficult to tell where one concept ended and another began. From one construct to the next there appeared to be only a slight change in focus. Yet that change may have been sufficient distinction. Just as a hammer may be either a carpenter's tool or a weapon, depending upon how it is used, an information system may be management, decision support, or strategic, contingent upon the kinds of decisions made with it. This fits well with the notion that the primary determinants of the nature of the information system are the decision and the decision maker.

One idea was clear in the literature. Definitionally, information systems were not just computers, even though many researchers in the field behaved that way (King and Cleland, 1978; Keen and Scott Morton, 1978). This was also true conceptually, as the next section suggests.

Research Streams on Management Information Systems, Decision
Support Systems, and Strategic Information Systems

Despite the instigation of information systems research by the technological revolution of the computer, conceptual frameworks which have been developed for the study of information systems stress the human more than the electronic or computational aspects of the systems. That the technological hardware and software-factors have generated more research was hard to overlook (Ives et al., 1981).

Conceptual Frameworks

Of the six conceptual models which were examined for this discussion, five have generated significant streams of research in the form of doctoral dissertations or published empirical studies (Ives et al., 1981; Lucas, 1977). The research frameworks, all offered as management information systems, served as an introduction to the literature on all three system types--MIS, DSS, and SIS.

Table 2.1 shows the conceptual areas covered by the six models. The broad categories include the development process, the characteristics of the system, the environments of the system, and the roles of the individuals considered in the model. Since literature discussed later will indicate the importance of development, it was surprising that these models, which sparked a number of research streams, paid little attention to system development. By far, the greatest emphasis was on the user and on the characteristics of the system. Even here, user demographics, such as educational

Table 2.1. Six Models of Management Information Systems and the Conceptual Areas That They Cover.

Theorists	Development Process	System Characteristics	Environment	Actors
Mason and Mitroff, 1973	----	mode of presentation	mentioned	user
Chervany, Dickson, and Kozar, 1971	----	format, access, decision tools	functional area, organization level, decision context	user
Lucas, 1975	----	quality	mentioned	user decision style
Mock, 1973	----	formality, decision, structure, and incentives	mentioned	user skills, knowledge
Gorry and Scott Morton, 1971	----	decision structure	organization level, decision level	user
Ein-Dor and Segev, 1981	mentioned	mentioned	mentioned	user, developer, top manager

level and age, were largely neglected. Perhaps the breadth of the models crowded out consideration of factors at their depth.

Certain fundamental aspects of system characteristics, such as whether or not the system is interactive, also were left out of these conceptual pictures of the information systems.

Management Information Systems

The MIS has become one of the most powerful tools available to a manager. It brings the force of enormous quantities of information to bear on decisions, increases the speed of data retrieval, controls access to data, and permits the use of analytical tools undreamed of in the pre-machine age. In spite of these benefits, it is also one of the most notoriously difficult tools for a manager to use (Ein-Dor and Segev, 1981).

Even with the obvious power of the MIS and its clear aid to managers in operational settings, as well as the assistance provided in some strategic situations, recent literature dwelt on the failure of MIS's. The complaint has echoed through more than a decade of MIS research: computers have achieved a great deal in clerical applications, but their impact on management has been rather small (Churchill, 1969; Blanning, 1983; Mintzberg, 1971).

Management Information Systems Failures and Problems

Lucas (1975) offered the most comprehensive list of reasons for MIS failure. First, users did not understand much of the output they received. Second, input and output were duplicated. Third,

users were not consulted about changes in the system. Fourth, inaccuracies caused users to discount all output from the system. Fifth, users complained of information overload. Sixth, users did not use what the system provided.

These were by no means the only reasons. Table 2.2 shows a more complete list of reasons for MIS failure. Shown across the top of the table, the three categories of causes for system failure were system inadequacies, user inadequacies, and development process difficulties.

While these difficulties, which reflected organizational, educational, and communication problems, were considerable, the literature also gave solutions to the problems which MIS created.

The first solution offered in the literature for solving problems with MIS was to apply strategic management principles to the development and operation of the system. By doing so, the needs of the users could be accounted for simultaneously with the constraints on the system (Ebenstein and Kraus, 1983). The second solution, almost equally broad, was to involve the user in every stage of system development. Starting with the determination of user needs and resource constraints, this technique assumed a "marketing" approach to select the system which fit the needs most closely (Tricker, 1982). Similarly, a third solution was to ensure that MIS planning was coordinated with corporate strategy. A systems planning committee, internal audits to evaluate the systems

Table 2.2. Reasons for MIS Failure Cited in the Literature and Categorized by User, System, and Development Process.

System	User	Development Process
inflexibility (Dery, 1982)	resistance to change (Shio, 1980)	poor implementation (Dery, 1982)
false assumptions in software (Shio, 1980)	lack of educa- tion or train- ing (Lucas, 1975)	lack of bottom line justification (Shio, 1980)
inaccurate input (Lucas, 1975)	not using avail- able, worthwhile output (Lucas, 1975)	poor communications between technical personnel and managers (Gerstein and Reissman, 1983)
redundancy in output (Lucas, 1975)	failing to under- stand output (Lucas, 1975)	myopic view of the computer (Gerstein and Reissman, 1983)
		no consultation with user on changes (Lucas, 1975)

planning effort, and a systems approach were key elements in this solution (Litecky, 1981).

While these solutions took an overall approach, far more literature exists for the solution of specific, smaller problems. Table 2.3 shows some of the areas that were covered and a review article on the literature in each area. In particular, articles covering these areas may be found especially in the management science and operations research literature, which includes general models and models for specific functional areas.

MIS and Individual Differences

Based on the conceptual discussion and on the streams of research which were touched upon, individual differences in terms of cognitive style, personality, and demographic variables clearly had an impact on MIS design, operation, and use (Zmud, 1979). In Table 2.4, some specific topics and studies on them are shown.

Individual perceptions and thinking behavior are reflected in the literature on cognitive styles, although it was recognized that these also depended upon demographic variables (Chervany and Dickson, 1978). The manner in which a person adapts to events, people, and situations was the definition of personality, although maladaptation may have attracted more attention. Along with these two factors, the background of the principal system users was also critical.

This body of research reflected the contingent nature of management information systems, a phenomenon which was predictable from the theoretical models already discussed. Serving different

Table 2.3. Specific Model Types for the Solution of MIS Problems and Review Articles Which Cover Them.

Areas	Review Articles
project management	Crowston, 1971
queueing networks	Denning and Buzen, 1978
office information systems	Ellis and Nutt, 1980
traffic assignments	Gartner, 1980
market simulations	Elton and Rosenhead, 1971
distribution planning	Geoffrion, 1976; Gregory, 1976
forecasting	Gilchrist, 1974
utilization of models	Gruber and Niles, 1971

Table 2.4. Topics and Studies on the Influence of Cognitive Style, Personality, and Demographics on Management Information System Design, Operation, and Use.

Cognitive Style		Personality		Demographics	
Topics	Studies	Topics	Studies	Topics	Studies
ability to deal with complexity	Schroeder et al., 1967; Fox, 1981	anxiety level	Klaus and Jewett, 1974	knowledge of systems	Klaus and Jewett, 1974
abstractions vs. systematic processes	Huysman, 1970; Rumelhart, 1971; Newell, 1972	risk taking propensity	Ginter and Rucks, 1982	general intelligence	Lucas, 1974
use of internal and external sources of information	Slovic et al., 1978; Newell, 1972	ambiguity tolerance		age	
		dogmatism		gender	
		clashes		education	
				organization level	

functions and taking different frames of reference, not all MIS's were the same. Some of these differences were reflected in the classifications of information systems discussed in the sections which follow.

A Classification of Information Systems

Mason (1976) conceived of five information related functions which could be carried out by either a management system or an information system. Based on the extent to which they carried out these functions, he classified information systems. The classes and the functions each class carried out are shown in Table 2.5.

This concept reflected accurately the degree of management involvement as the system performed more and more of the work. Much of the literature published in the name of management information systems had little to do with management, but rather with the technical aspects of software and hardware. Possibly in reaction to this data processing/operations research view of information systems, another concept, the decision support system, was developed (King and Cleland, 1978; Keen and Scott Morton, 1978).

Decision Support Systems

Decision support systems (DSS) were concerned primarily with the role of the computer in management (Keen, 1980). The focus was upon unstructured and semi-structured decision-making at all levels of the organization.

Table 2.5. A Matrix Based on Mason's (1976) Functions and Classifications of Management Information Systems.

Function	Data Bank	Predictive MIS	Decision-Making MIS	Decision-Taking MIS
source	X	X	X	X
data	X	X	X	X
prediction		X	X	X
value			X	X
action				X

On one hand, critics called DSS a repackaged version of MIS (Naylor, 1982). On the other hand, defenders argued that much distinctive research had taken place on the topic, but that vendors and some academicians were guilty of using the term as new dressing for the same old thing (Blanning, 1983). Table 2.6 shows some of the topics and related studies which were cited by defenders of DSS as a separate discipline (Blanning, 1983).

Nonetheless, there was a strong relationship between MIS and DSS, especially in the study of behavioral issues. From the two bodies of literature, it appeared that the determinants of success for one were also the determinants of success for the other (Blanning, 1983).

A Classification of Decision Support Systems

Alter (1980) developed classifications of decision support systems similar to Mason's (1976) for management information systems. Based essentially on the degree to which they modified data, Alter claimed that these systems ranged from extremely data-oriented to extremely model-oriented.

The classifications are shown in Table 2.7, alongside Mason's functions and Alter's own operations. Except for the decision-taking category, which may be associated more with clerical than managerial functions, the two classification systems overlap.

DSS, while taking a more user oriented approach to the information problems of the organization, still did not satisfy the organization's need for screening processes, nor did it place the

Table 2.6. Topical Areas and Related Studies Cited in Defense of Decision Support Systems as a Discipline Separate from Management Information Systems.^a Based on Blanning, 1983.

DSS Topics	Studies
capture of organizational members knowledge	Bonczek et al., 1980; 1979
management of models	Sprague and Watson, 1975
data base management systems	Blanning, 1981; 1980; 1983
information management systems	Donovan, 1976; Blanning, 1982; Pick et al., 1982; Sprague, 1980; Sprague and Carlson, 1982; Wang and Courtney, 1982
information economics	Keen, 1981; Kimbrough, 1982; Hackathorn, 1981
cognitive styles of decision makers	Bariff and Lusk, 1977; Vasarhelyi, 1977; Henderson and Nutt, 1980; Keen and Bronsema, 1980; Watkins, 1980; Taylor and Benbasat, 1980
task structure	Mintzberg et al., 1976
organization size and structure	Ein-Dor and Segev, 1978
manner of presentation	Dickson et al., 1977; Lucas, 1981
development process	Brightman and Harris, 1982

^aBased on Robert W. Blanning. "What is happening in DSS?" Interfaces 13:5 (October, 1983), 71-80.

Table 2.7. Alter's Classification of Decision Support Systems and Operations in Juxtaposition to Mason's Information Systems' Functions.

Alter's Classifications ^a	Atler's Operations ^a	Mason's Functions ^b
file drawer	retrieval	source
data analysis	ad hoc analysis	data
analysis information		
accounting models	estimating	prediction
representational models		
optimization models		
suggestion models	making decisions	decision-making decision-taking

^aStephen Alter. Decision Support Systems: Current Practice and Continuing Challenges. Reading, Mass: Addison-Wesley, 1980.

^bRichard O. Mason and Ian I. Mitroff. "A program for research on management information systems," Management Science, 19 (January, 1973), 475-487.

computer's role in perspective with respect to the decision-making process. Implying that only large organizations have any use for DSS, Hadass and Seev (1982) attributed many of the DSS's problems to the lack of an organizational unit devoted to the development and maintenance of such systems.

If the description of DSS as computerized mind-support for executive problems were true, it still did not change the tendency of information systems research to focus rather narrowly on the computer (Wagner, 1981). The fact remains that these systems, like MIS, have not lived up to the expectations of their creators or the managers who use them (Mintzberg, 1968).

Solutions to Decision Support Problems

Fuerst and Cheyney (1982) suggested that user training, accuracy and relevance of output, and the experiences of the user were the determinants of a successful system, implying that user education is part of any solution. Paralleling statements already made about MIS (Lucas, 1974), they argued that the system must fit the user and be regarded by users as useful. In a general solution identical to one for MIS (Ebenstien and Kraus, 1983), the use of strategic planning processes to develop decision support systems was recommended (King, 1983).

Strategic Information Systems

A number of authors offered what they called information systems for strategy. These fell into two categories, as shown in

Table 2.8. As an example of the first category, structured computer software, Holloway and Pearce (1982) proposed a three-tiered, computer-assisted planning system. The first tier consisted of a simulation model to provide the overall pattern and context of planning. As a second tier, they suggested a multi-year linear programming model which can be used for feasibility studies and general operating plans. A one-year linear programming model to develop detailed operating plans and budgets was the third tier.

In the second category, comprehensive conceptual framework, Henderson and Nutt (1981) described a three dimensional approach to the strategic information systems itself. Four elements were included in the SIS: (a) personal experience; (b) interaction; (c) reports; and (d) analysis. Depending on the stage in the strategic management system and the state of the environment, these elements change in importance within the information system.

The other broad concepts of the strategic information system emphasized the system as a link between the environment and the strategic process, and so will be discussed in the next section.

Strategic Information Systems and Strategic Management

Fitting the organization to the environment was a fundamental issue in the strategic management literature (Glueck, 1980). While the need to generate information about complex, changing, and often hostile elements in the firm's surroundings was recognized

Table 2.8. Two Categories of Strategic Information Systems Found in the Strategic Management and Information Systems Literature and Examples of Each.

Strategic Information Systems	
Structured Computer Software	Comprehensive Conceptual Frameworks
Holloway and Pearce, 1982	Henderson and Nutt, 1981
Sethi, 1981	Radford, 1978
Chen, 1977	King and Cleland, 1978

theoretically, only a limited amount of research has been published on either the external or internal scanning processes (Hambrick, 1982; Henry, 1980).

Although these views do not represent the main body of work on scanning (Thompson, 1980), the organization has been conceived as an information processing entity (Miller and Friesen, 1983) that interprets the environment on the basis of executive assumptions and the intrusiveness of the organization (Daft and Weick, 1984). The emphasis these concepts placed on scanning activities is clear.

The main body of scanning literature fell into three categories, as shown in Table 2.9. The specific techniques for scanning, such as SPIRE (Klien and Newman, 1980) and GLOBESCAN (Hofer and Haller, 1980), identified specific areas and suggested specific variables and behavior that should be watched in those areas. Closely related to these techniques, the segmentations of the environment served either analytical or educational purposes. They were essentially intuitive, convenient, and sometimes useful.

Requiring more detailed discussion are the works in the category for empirical research. By asking executives how frequently they learned about events in 20 environmental subsectors, how interested they were in events in each subsector, and how much time they spent scanning in each subsector, Hambrick (1982) was able to measure managers' scanning activities. Other studies linked scanning activity and organizational success. Determining the need for and usefulness of scanning depended upon the factors shown in Table 2.10, along with the works that examined them.

Table 2.9. Three Categories of Scanning Literature and Examples of Each.

Techniques for Scanning	Environmental Segmentation	Empirical Research
Klien and Newman, 1980	Miles and Snow 1978	Hambrick
Jain, 1979	Ansoff, 1979	Aguilar, 1967
Hofer and Haller, 1980	Glueck, 1980	Dollinger, 1984
Reed, 1977-78	Stoner, 1983	Blaylock and Rees, 1984
Terry, 1977	Steiner, 1979	Schwenk, 1984
Neubauer and Solomon, 1977	Hodgetts and Wortman, 1980	Shrivastava and Mitroff, 1984
King and Rodriquez, 1977		Dirsmith and Covalesski, 1983
Belolou and Waggoner, 1980		Croon, 1979
		Stevenson, 1976
		Henry, 1980

Table 2.10. Studies Which Have Examined Links Between Scanning Activities and Organization Success and the Influences Which They Examined.

Studies	Influences on Scanning Activity
Hambrick, 1982	industry firm operates within
Dollinger, 1984	organizational size
Blaylock and Rees, 1984	cognitive style of the scanner
Schwenk, 1984	method of presentation of information
Shrivastava and Mitroff, 1984	assumptions made about the environment

An essential conclusion, reached by several researchers studying different factors, was that the strategists must interact frequently with the environment (Dirsmith and Covalleski, 1983; Hambrick, 1982; Daft and Weick, 1984). Indeed, some interpretations placed scanning at the center of the strategic process (King and Cleland, 1978), while one theorist viewed the strategic information system as central to the future study of strategic management (Stiles, 1981).

Far more authors dealt with scanning the external environment than with scanning the internal environment (Henry, 1980; Hofer, 1977; Croon, 1979. Stevenson, 1976; and Henry, 1980 were the exceptions. Assessing sensitivity analysis, life cycle analysis, strength and weakness investigations, and the analysis of strategic objectives as tools for internal analysis, Croon found all of them useful in developing strategic alternatives.

In order to fit the firm to its environment, Henry (1980) described the process of scanning as searching the external environment for threats and opportunities, while monitoring internal strengths and weaknesses. The scanning functions were central to Henry's concept of the strategic management process (Henry, 1968).

Fitting well with the idiosyncratic nature of information, Stevenson's (1976) finding with respect to strengths and weaknesses suggested that information about them was most useful if it fed back into the individual manager's strategic management process. He defined strengths and weaknesses in terms of the ability to carry out tasks and characteristics which inhibit the achievement of goals.

Although the work discussed so far dealt only indirectly with the strategic information system in management, the tie was made explicit by King and Cleland (1978) and Radford (1978). Subdividing the environment in a manner similar to other theorists (see Glueck, 1980), King and Cleland identified the SIS as a system capable of answering specific questions about subsectors through either data based or qualitative analysis. Their strategic management concept was involved at all stages with the SIS.

Herein lay one of the most significant limitations of SIS as presented by King and Cleland. Table 2.11 shows the strategic management process (Hodgetts and Wortman, 1980) in relation to King and Cleland's (1978) strategic information system, strategic process, and sources of information. In this instance, data were being gathered from all external sources and supported the strategic process only as far as the analysis and formulation stages.

The difference between the two strategic processes was both theoretical and historical. Where the strategic management process goes on to implement, interpret, evaluate and integrate plans for the organization, the process which King and Cleland show in their theory was strategic planning. In the late 1960's, when strategic planning was the newest concept, companies went through elaborate processes, produced planning documents, and expended many hours, but did not seriously attempt to implement the plans (Henry, 1978). In the literature, the strategic information system was limited by the same view.

Table 2.11. King and Cleland's Strategic Information Sybsystems, Sources and Strategic Planning Process Juxtaposed with Hodgetts and Wortman's Strategic Management Process.

Strategic Management (Hodgetts and Wortman, 1980)	Strategic Planning (King and Cleland, 1978)	Strategic Information Subsystems (King and Cleland, 1978)	Information Sources (King and Cleland, 1978)
	situation assessment	image customer	customer
analysis	objective development	potential customer	potential customer
	constraint identification	competitor regulator	competition government
formulation	selection	critical	
implementation			
interpretation			
evaluation			
integration			

Radford (1978), whose strategic information system was based on qualitative, human, sometimes illicit intelligence from the external environment, consigned all internal information to an MIS, which was left largely quantitative and computerized. As presented, his strategic process also stopped after analysis and formulation.

By devoting all of their attention to the external environment and to subsystems which gather information on it (King and Cleland, 1978; Radford, 1978), the major theorists left out a major part of the process. They also neglected systems, not necessarily computerized, which convert data into information. In a sense, data were gathered in these systems, and then were used, but no explanation of what happened to it between those stages was offered.

Thus, the concept of strategic information systems was not fully integrated with the strategic management process in the literature. While it drew to some extent on the MIS, DSS, and strategic management theory, it did not reflect the full maturity of that foundation. Its distinction from MIS, and especially DDS, was questionable. As shown in the literature, the SIS also failed to recognize the idiosyncratic nature of information, excluding, for example, most of the internal information generated by the organization.

So far, Stiles (1981) claim that SIS will be the focus of strategic management research for the next decade has not occurred, but there were indications of a trend in that direction. The high level of interest in environmental scanning (Wortman, 1983) was one indicator. Daft and Weick (1984), King and Cleland (1978), and

Hambrick (1982) showed strong inclinations to pursue further research in these areas.

While limited, the literature suggested a powerful link between the SIS and the strategic process. Only conceptual difficulties kept the focus too narrow.

Strategic Information Systems in the Motor Carrier Industry

Probably because it came before deregulation, the one research project on strategic management in the motor carrier industry fell among the minority of studies which failed to show an association of the process with high profitability (Kallman and Shapiro, 1978; Armstrong, 1980). Eliminating the incentive to manage strategically, there was little need to gather strategic information or to develop systems for doing so. The literature reflected this dearth of activity.

The literature on information systems in the motor carrier industry was devoted entirely to the use of the computer, either as an analytical tool or as a communication device. On MIS, DSS, or SIS, no systematic research was conducted.

Shrock and Ostrum (1981) surveyed the motor carrier industry to determine how computers and computer analysis were being used. Strongly suggesting that motor carriers would benefit from an increased use of data bases and computer models, they found that motor carriers used computers primarily to keep records.

Under the heading of DSS, specific models have been developed for fleet management (McKenzie et al., 1982), traffic routing, balancing, scheduling, and other operational uses (Ballou, 1976). With the exception of McKenzie et al. (1982), these had no strategic applications. Even the fleet management model was only useful to very large firms.

A Model of the Strategic Information System

Based upon the literature, it was possible to draw some conclusions about the processes involved in a strategic information system, as well as identifying weaknesses in the concept. These processes should be associated with certain tasks or functions. As Figure 2.1 shows, the principal functions are: (a) identifying of factors in the environment which significantly affect either the cost of providing services or the relationship between the firm and its customers; (b) monitoring these factors and showing their interactions; (c) locating, analyzing, reducing, and synthesizing data; and (d) adapting to the changing environment and to the demands of the strategists.

In the strategic information system there are five processes. First, scanning is an active process which ensures that all relevant data are available to the decision-maker. In the second process, filtering, data are located and reduced to eliminate redundancy and overload. It is a passive process which complements scanning. To further reduce the data and give them a form that is appropriate to their qualitative or quantitative nature is the third process,

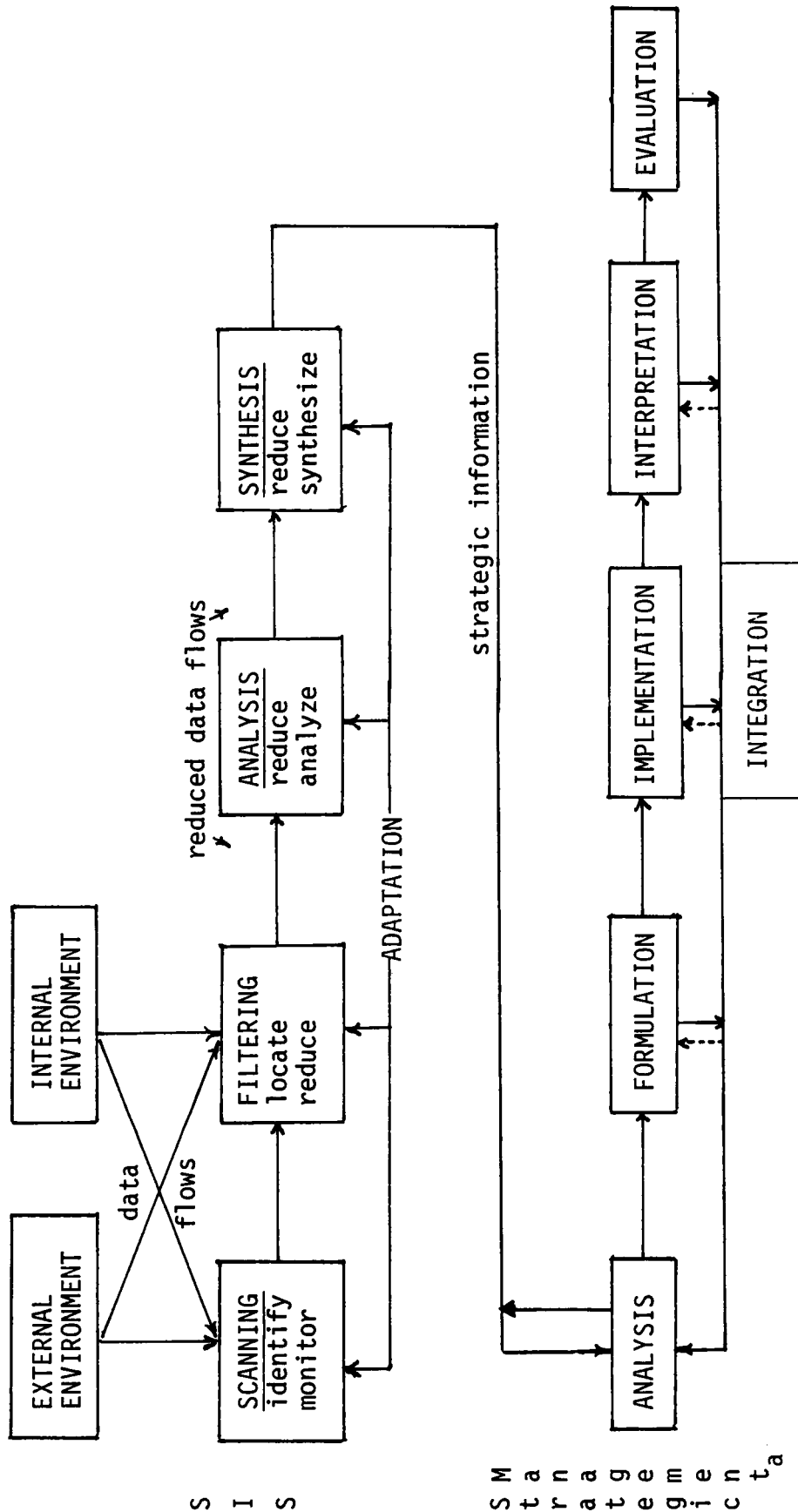


Figure 2.1. A Comprehensive Model of the Strategic Information System.

^aAdapted from Max S. Wortman, Jr. "Strategic Management and Changing Leader Follower Roles," *The Journal of Applied Behavioral Science*, 18:3 (1982), 371-383.

termed analysis. Reducing data still further and condensing it in the context of the decisions which must be made is synthesis, the fourth process. Finally, the adaptation process feeds back instructions from each of the other processes and form the strategic management process in order to take into account the decision-makers' preferences and special requirements at each stage in the system.

As data flow through the model they are gradually reduced and converted into strategic information. What flows from the environments into the SIS are data--facts and figures. At each step in the SIS, these data are aggregated, altered, and presented in forms demanded by subsequent tasks and feasible in terms of the firm's abilities and the degree to which the data are amenable to changes. At length, strategic information, data which have been altered to suit decision-maker preferences and the decision, flows from the strategic information system into the strategic management process at whatever stage it might be required. In summary, data flow from the environment into the SIS, reduced data flow through the SIS, and strategic information flows from the SIS to the strategic management process.

Compared to the concepts presented in the literature, this model has several distinctive features. First, it recognizes the need for strategic information in all phases of strategic management. Second, it includes the adaptation process which permits adjustment of the system to demands made by the strategic process and the strategists. Third, it encompasses both the internal and external environments. Finally, both quantitative and qualitative information and data are compatible with the system which it describes.

Summary

In drawing from the bodies of literature, the current state of theory and research on strategic information systems was made clear. From the information systems literature came the notions of management information, decision support, and strategic information systems. The three concepts were not easily distinguished.

Practice suggested, along with much of the literature, that MIS and DSS were both primarily concerned with the computer and its role in either the organization or in management (Keen and Scott Morton, 1978). By contrast, strategic information systems theory focused either on the external environment (Radford, 1978) or on the development of decision assisting software (Holloway and Pearce, 1982).

Linking the information system to the strategic management process brought about a concentration on the three dimensional concept of strategic information systems (Henderson and Nutt, 1981), which included the environment, the strategic management process, and the characteristics of the system itself. King and Cleland (1978) also developed a theory which emphasized the development of subsystems which corresponded to segments of the environment. These and related works did not use a full strategic process concept, but rather stopped at the planning stage, leaving out implementation, evaluation, and integration (Hodgetts and Wortman, 1980).

With this stress on the external environment and linked systems, the tie to the environmental scanning literature was clear.

External scanning was emphasized over internal scanning, especially in theory (Wortman, 1983), although empirical work had been done in both areas (Hambrick, 1982; Stevenson, 1976).

Based upon this literature, a conceptual model, shown as Figure 2.1, was developed which attempted to alleviate the weaknesses of the concept. This model showed data and information flows, incorporated both the internal and external environment as sources of data, and involved the complete strategic management process as given by Hodgetts and Wortman (1980). In Chapter 8, this model will be altered in keeping with the results of this research.

CHAPTER 3

METHODS AND PROCEDURES

This chapter defines the terms, states the research questions, and details the methodology for this project.

Definitions

In any project of this nature, terms are used which may have multiple meanings in the literature. Since this project drew heavily from two distinct bodies of literature in fields with definitional problems (see Chapter 2 and Wortman, 1983), the author developed the definitions which follow.

Management information system: A set of processes for collecting, analyzing, and filtering routine, well-defined information into management reports which guide and control operations. Unlike the two categories of definitions discussed in the previous chapters (Ein-Dor and Segev, 1981), this definition was based on the nature of the information and the decisions made with it, rather than the organizational function or the nature of computer hardware and software. This helped to separate the management information system (MIS) from the decision support and strategic information systems, while reflecting practice in the field.

Decision support systems: Processes which make computer data bases and analysis tools routinely available to management and under the decision-maker's control. Because the key element in decision

support systems (DSS) was the computer (Keen and Scott Morton, 1978) a DSS might be used as part of any information system. Once again, this definition was in keeping with practice in the field and in the literature.

In effect, DSS was not a distinctive form of information system, but a way of physically establishing the relationship between the computer and the decision-maker.

Strategic information system: A set of processes which integrate qualitative and quantitative information, computer-based and non-computer-based, as required by the strategists and the strategic decision-making processes of the firm. Lacking any concise definitions from the literature, this definition was based, like the MIS definition, on the nature of the information and the decisions to be made. Because it was likely to be crucial in these systems, the demands of the decision-makers were included explicitly.

Motor carrier: A common carrier of general freight; a trucking firm which holds out its services to the general public between designated points at published rates. Although deregulation weakened the common carrier concept, this definition was widely accepted and distinguished the firms included in this study from other carriers and firms in other industries.

Strategic information systems design: The identification of relevant data areas to be scanned to obtain information necessary for effective decision-making. In the literature, no definition of this

term was found. It represents the first major strategic information decision, which could be made by using the technique, SPIRE, proposed by Klein and Newman (1980), for example.

Strategic information systems organization: The coordination of the relationships between human, technological, and computational elements in the strategic information system. Ein-Dor and Segev (1981) referred to the system development process, but this definition was more immediate and specific. Incorporating decision support systems into a strategic information system would be an example of a strategic information systems organizational decision.

Strategic information systems method: The procedures through which data are located, collected, analyzed, stored, and used for strategic decision-making. This definition drew to some extent from the literature on information systems (see Burch et al., 1978, Chapter 1, for example), but had no counterpart in any earlier work. In terms of decisions which must be made about strategic information systems, methods embody the answer to any questions about how data and information are to be managed.

Strategic actor: One who performs key functions in the strategic management process.

Principal actor: One who performs key functions in the strategic information system, or in the environment.

Scanning: The process of monitoring the internal and external environments of the firm to identify strengths and weaknesses, threats and opportunities. In the strategic management

literature, a distinction seemed to appear between scanning the external environment (see Stevenson, 1976) and identifying internal strengths and weaknesses (see Henry, 1980). Although the availability of data may differ, the managerial function of scanning is the same for both the internal and external environment. This definition makes the homogeneity explicit.

Filtering: The process of preventing extraneous data from entering the strategic information system. Not included in any portion of the literature, complaints made by users (see Lucas, 1975) about information overload seemed to make it essential in the strategic information system.

Analysis: The process of examining data for relationships which might influence strategic decisions. Unlike the analysis stage of the strategic management process (see Hodgetts and Wortman, 1980), this term was narrowly focussed upon the nature and manipulation of data in the context of a specific decision. No similar definitions were found in the literature.

Synthesis: The process of bringing all relevant, available data and information for a particular strategic decision together. The need for this term arises from the user demands for complete, timely, and useful information (see Lucas, 1975).

Research Questions

In order to fulfill the purposes of this project--to explore the design, methods and organization of strategic information systems (SIS)

in the motor carrier industry, and to construct a prescriptive model of SIS in the industry--the answers to certain key questions were sought. They related specifically to certain aspects of the SIS, but permitted an open-ended approach to the subject through the interview questions. They also assisted in the development of detailed tables related to the SIS. The key research questions were:

(a) What are the crucial areas which must be scanned to allow effective decision-making in the motor carrier industry?

(b) What are the key variables which describe the areas of interest in each of these crucial areas?

(c) Do those responsible for strategic decision-making feel satisfied with the current scanning process?

(d) To what degree are the firm's computer systems integrated into the SIS?

(e) What software, including analytical packages and data base management systems, contributes to the SIS, and how does it relate to the other SIS elements and variables?

(f) How is the firm currently collecting and processing strategic information for decision-making?

If the strategic information process should be aimed at some part of the organization's surroundings or at a part of the organization, which seemed valid based on the literature, then the answers to the first two questions should help to examine both the importance of specific variables and the logic of the strategic information process in a particular firm.

Questions (c) and (f) were designed to give some idea of what the system was, as well as a view of how well managers perceived it to work. Taken together, the answers to the two questions should provide an overview of the motor carrier SIS.

By answering questions (d) and (e), the computer's role in SIS's in the industry should be brought out. Since computers are likely to play an increasingly important role in the motor carrier industry, what is being done with them is crucial to understanding the strategic information process.

By analyzing the answers to all of these questions, the purposes of this research could be accomplished. However, since the research questions were not suited for use in the interviews, another list was compiled for each category of manager expected to be in the sample. In Table 3.1, these questions are listed, while Appendix A contains replicas of the interview forms used in the field.

Underlying the interview questions were the strong links between the decision to be made, the nature of the information, the sources of information, and the questions specific to functional areas of the business.

In general, computer description questions were to be asked primarily of MIS managers, while marketing and finance managers were to be asked questions specific to their areas. Since all three groups of managers could be expected to pass information on to the CEO, several questions dealt with flows of information upward. As for the CEO's questions, they were designed to get an overview of the firm and of the flow of strategic information within it. It was

Table 3.1. Guideline Questions for Interviews with Managers in the Motor Carrier Industry: For SIS Research, June, 1983-February, 1984.

Questions for the CEO:

What are the important decisions that you make?
How do you make these decisions?
How do you know when you need to make these decisions?
What information do you have difficulty obtaining?
What information would you like to have, but cannot get?

Questions for marketing and accounting/finance managers:

What are the important decisions that you make?
How do you make these decisions?
How do you know when you need to make these decisions?
What do you need to know to make these decisions?
How do you use the computer or a formal information system to help make these decisions?
What information do you have difficulty obtaining?
What do you do with the data or information after you have obtained it?
What information do you give the CEO?
What would help you do this part of your job more effectively?

Questions for the MIS/DP manager:

What computer system do you have?
What data base management system do you use?
Is your data base distributed, centralized, or decentralized?
What analytical software do you have available?
What kinds of data does your unit give to marketing, finance, or accounting?
What is the current level of utilization of the available capacity in your system?
How long is your queue for new applications for the computer?
Do you consciously employ sources of information or analysis other than the computer?
What changes would you make in your system to improve it?
What would help you do your job more effectively?

possible to analyze the perceptions of managers from each group as to the effectiveness of the system, so that general principles could be identified, as well as discrepancies.

Methodology

This research employed open-ended interviews with managers and executives in 22 firms, 20 in the primary sample and two as a pretest of the interview procedure. In establishing the methodology, the principal issues were the selection of firms for participation in the study, the identification of individuals within those firms who could provide the information needed to complete the research, and the methods to be used for analyzing the data. Each of these subjects is discussed in the sections which follow.

Sampling: Selection of the Firms

A convenience sample was used in this project. After contacting the CEO's in 24 firms by telephone, 22 agreed to participate. When additional information was requested about the project, the summary shown in Appendix B was sent along with a note confirming the interview arrangements.

Since it appeared from the outset that the size of the organization would heavily influence the formal SIS, a range of sizes was sought in the sample. Recognizing that the motor carrier industry consists predominantly of small firms (approximately 18,000 of 20,000 have annual gross operating revenues less than \$5 million), it was also necessary to acknowledge that more information

would probably be gained from the larger participants. Consequently, firms were sought in three categories: (a) small: annual gross operating revenues (AGOR) less than \$20 million; (b) medium: AGOR \$20-100 million; and (c) large: AGOR greater than \$100 million.

From the standpoint of location, firms were chosen primarily in the southeastern United States. Stemming from budget constraints, this was the major delimitation of the study.

Sampling: Identification of Individuals

To gain efficiently enough information to carry out this research, it seemed necessary to interview the CEO and the individuals responsible for the functions of marketing, accounting/finance, and MIS. Since the CEO was expected to be the chief strategist, this selection was clearly essential. Each of the functional areas was believed likely to have a critical role in generating strategic information, as well as in making strategic decisions in medium and large firms. That accounting/finance and management information systems would be directed primarily toward internal scanning and filtering, while marketing would focus on the external environment, was also anticipated.

In small firms, it was believed that one person would be responsible for two or more of the functions of interest in the project. When this occurred, all questions pertaining to an individual's responsibilities were asked during the interview.

To assure that the appropriate persons were included in the research project, contacts either by telephone or in person were made

with members of the board, the CEO's, and knowledgeable outsiders. These contacts were given the nature and purpose of the project and then asked which executives in large firms would have relevant information and be willing to talk about it. When recommendations were made, they were followed.

Analysis of the Data

After gathering the data, tables and conceptual models were used to analyze the content and relationships in them. Answers to each of the questions were analyzed for specific content and theoretical implications. Since the data-gathering methods were qualitative and the nature of the data was not amenable to numerical analysis, no statistical techniques beyond the use of frequency tables were considered.

Among the relationships analyzed were those between the SIS elements, the decision-making environment for SIS usage, and the role of the computer in the process. The current state of computer usage and technology in the sample firms was also examined.

The paths which data and information take through the firms were compared to those shown in the model in Figure 2.1. Value judgments were made about how well firms in the industry were conducting their SIS's, based on tabular information and on what is still possible, but not being used. Both the theoretical foundations and the activities of the firms in the sample contributed to the construction of this final prescriptive model.

Summary

In this chapter, the definitions for the principal systems types--decision support, management information, and strategic information--were given, along with those for other key terms, such as scanning and analysis. The foundation for the definition and the relationship were given in each case.

Six research questions were posed and justified, four dealing with managerial and organizational processes and two with the role of the computer. Designed to permit an open-ended interview approach to the interviews, they were intended to cover all significant aspects of a strategic information system and to facilitate tabular analysis of the data.

To facilitate interviewing, specific questions were developed for the CEO, marketing, accounting/finance, and MIS managers. These questions appear in Appendix A and in Table 3.1.

Selecting the subjects for interviews was a two-step process. First, firms were asked to participate. Once the authorization was granted, people inside and outside the firm were contacted to assure that the key individuals in each firm were included in the research. The project used a convenience sample of firms, largely from the southeastern United States.

Data were analyzed through the construction of tables and models which related to the answers to each of the six research questions. Employing information developed from the interview data, the model in Figure 2.1 was revised to show the results of the

research. Value judgments and evaluations of current practice in the sample firms on the basis of the literature were used in the construction of the models and tables.

CHAPTER 4

ANALYSIS OF RESULTS: PART I

Introduction

In this chapter, the sample of firms and interview subjects is described. The analysis begins with discussion of the typical firm in the three categories--small, medium, and large--are shown in Chapter 3. Then, significant variations from the norm are related. Tabular presentation and analysis take place simultaneously under each research question.

Sample Description

After contacting the CEO's of 24 firms, a convenience sample of 22 firms agreed to participate in the research. One firm's CEO did not return any of three phone calls, while the other non-participant indicated that cooperation with outside researchers was against company policy. Because many of the firms' managers and executives had close ties with The University of Tennessee, Knoxville, transportation program, few difficulties were encountered in gaining access to these organizations.

Geographic Dispersion

Except for a single firm in the Midwest, all of the participating organizations were headquartered in the Southeastern United

States. Nineteen were with a 300-mile radius of Knoxville, Tennessee. In the 11 smallest firms, corporate offices also served as the hub or principal terminal. The headquarter's site determined principal markets in all but the four largest firms, which served all the contiguous 38 states. All 22 firms were involved in the Southeastern market, while 12 operated between the Southeast and the Midwest, two between the Southeast and the West Coast, and two between the Southeast and the Southwest. To a great extent, the degree to which firms extended services beyond their immediate region was a function of firm size, which is discussed in the next section.

Firm Size

Although the Interstate Commerce Commission (ICC) has classified motor carriers, the ICC categories were too broad for the purposes of this research project. Fifteen of the firms would have been considered Class I (AGOR greater than \$5 million) according to the ICC, providing little basis for making distinctions between firms. Using the ranges of 1982 AGOR described in Chapter 3, Table 4.1 shows the number of firms in the study which fell into each classification.

For convenience in the discussion, the first category is referred to as small, the second as medium, and the third as large. The categories proved, with significant exceptions which will be discussed, to fit in with major breaks in operating methods, management, and organization. Perhaps this was the result of size gaps in the sample, since the largest firm in the first category (small) was approximately one-half the size of the smallest firm in the second

Table 4.1. Categorization of Motor Carriers in the Sample Used to Study Strategic Information Systems According to 1982 Annual Gross Operating Revenues (AGOR).

Category	1982 AGOR Range	Number of Sample Firms in Each Category
small	less than \$20 million	8
medium	\$20-\$100 million	8
large	greater than \$100 million	6

category (medium) and the smallest firm in the third category (large) was almost twice the size of the largest firm in the second category (medium).

Because size was believed to be such an important factor in determining the nature of the strategic information system, a broad range of sizes was sought in the sample. The actual range of the sample firms was from \$1.2 million to \$1 billion in 1982 AGOR, so this objective was met. Despite this breadth, the sample failed to reflect accurately the composition of the industry, showing a bias toward larger firms. While 90% of the 20,000 firms in the industry had less than \$5 million in 1982 AGOR, only 25% of the firms in the sample fits this description.

Interview Subjects Within the Firms

The size of the firm, once again, heavily influenced the interviewing process. As Table 4.2 shows, five firms required only one interview--with the CEO. Simply put, these firms were small enough to need no division of strategic labor. In general, as the firms grew larger, the number of interviews conducted grew larger as well. At the large firms, at least four interviews were conducted, while only one small firm needed more than two.

Interviews were conducted with 62 managers and executives. Positions and titles did not always coincide with the author's preconceptions about the principal actors in the SIS. As a rule, motor carriers still rely upon pre-deregulation titles and organizational structures. In some firms, the marketing function was particularly difficult to

Table 4.2. The Number of Motor Carriers in Which Certain Numbers of Interviews were Conducted in a Study of Strategic Information Systems, June, 1983-February, 1984.

Number of Interviews Conducted	Number of Firms in Which that Many Interviews Took Place
1	6
2	5
3	4
4	3
5	2
6	2
total number of interviews conducted: 62	

locate, primarily because the duties associated with marketing in non-trucking firms were scattered among operations, traffic, and administration departments in the sample firms. A list of titles of the interviewees is provided in Appendix C.

Often both owning and operating the business, the CEO was the only strategic actor in most of the small firms. Some were founders or sons or daughters of founders. Although most of their time was spent on operational decisions, these individuals were close to both operations and strategy in their firms. Strategies, in their perceptions, seemed to be a means of operating in the environment in a flexible way, not necessarily in the long run.

Members of founding families also controlled seven of the eight medium firms and one of the six large firms. Not only that, but in two other large firms, heavy influences from the former proprietors of the business were still visible.

A common division of labor in the small and medium firms was for one member of the family to take operational responsibility for the firm, while another was in charge of strategy and outside contacts. If such a judgment may be based on the reported profitability of the firms which use it, this arrangement, and some hybrids of it, appeared to work very well.

As the firms grew larger, the number of factors in the SIS grew larger. Table 4.3 reflects this relationship, along with some exceptions. Increasingly remote from day-to-day operations, the CEO's in large firm nonetheless spent disproportionate amounts of time on operational decisions at the expense of strategic decision-making. This same

Table 4.3. The Number of Principal Actors in the Strategic Information Systems of Small, Medium, and Large Motor Carriers in a Convenience Sample of 22 Firms, June, 1982-February, 1984.

Size of Firm	Number of Principal Actors in the Strategic Information System					
	1	2	3	4	5	6
number of small firms	5	2		1		
number of medium firms	1	2	1	4		
number of large firms				1	2	3

remoteness increased their reliance on the managers of the functional areas to report essential information on customers or costs. In contrast, the CEO's of small firms were close to operations, even driving long haul trucks and making frequent sales calls. This proximity to daily activities may come at the expense of a longer, broader view of the firm and the industry.

Among the functional areas, marketing seem most comment. It was disjointed or non-existent in many of the sample firms. At the time this research was conducted, many of the marketing managers were newly appointed heads of newly created divisions. Even among the large firms, half of the marketing vice presidents were the first incumbents in positions that were less than one year old. Clearly, their organizations had not yet adapted to this new functional area, so that many traditional marketing activities--pricing, for example--were carried out by other departments in the organization.

Marketing, in the motor carrier industry, is fractionated. Relying on organizational structures created within a regulatory environment, motor carriers assign pricing, sales, and competitive assessments to traffic, operations, or administrative departments. This may have serious implications for the future of many firms, especially with respect to the ability to scan, filter, analyze, and synthesize data from the external environment. The institutionalization of the failure to coordinate and use market information may be most apparent and most serious among large firms, but will harm a firm of any size.

Representing a significant variation from this theme, one small firm had a carefully designed functional organization with four

principal actors in the SIS (see Table 4.3), a long-range plan for growth and profitability, a strategic planning committee, and a continuing relationship with outside experts in marketing and computer systems design. The marketing organization in this firm appeared to be professional, seasoned, and successful.

Two of the large firms could also claim success for long-standing marketing organizations, but these seemed to be exceptions. On the whole, motor carriers sell, price, and bill, but do not market, despite the changes in their operating and strategic environments.

Table 4.4 shows the number of firms with newly created (less than two years old) marketing organizations, the number of firms which had marketing organizations at all, and the number of firms which had no such organization. With only seven firms out of 22 having a marketing unit, the suggestion that motor carriers are not marketing-oriented becomes powerful. Even when size was considered, eight of the 14 medium and large firms had no marketing group.

Perhaps too much could be made of either side of the case. Some firms with marketing functions were in just as much difficulty as those which had none, while some which lacked them were doing quite well. Nevertheless, the possibility of a long term structural failure in the industry, a failure to organize to meet the environment, seemed genuine.

Table 4.4. The Number of Motor Carriers from the Sample Which Had Newly Organized, Long-Standing, or No Marketing Organizations, June, 1982-February, 1984.

Number of Firms Which Had A Marketing Organization		Number of Firms With No Marketing Organization
Newly Organized	Long Standing	
5	2	15

Summary

Certain factors--sample characteristics, interview subjects, marketing organizations in the industry--affected the answers to all of the questions in this research. To some extent, consequently, the answers must be considered in the context of these influences. As an industry, motor carriers are apparently still making the adjustment to deregulation, with some attendant traumas. Developing a new approach to customers, the beginnings of marketing organizations were apparent in the firms in this sample. Eight medium, eight small, and six large firms were included. Sixty-two interviews were conducted with principal actors involved in these firms SIS's, with the number of actors in each organization tending to increase as the carrier's AGOR for 1982 increased.

Cooperation in the study was excellent. Of 24 firms contacted, 22 agreed to participate in the research. Interviews ranged in length from 30 minutes to two hours, with the norm at one hour per manager or executive. Based on the analyses which appear in subsequent chapters, the size of the carrier was an important determinant of the nature of the strategic information system.

CHAPTER 5

ANALYSIS OF RESULTS: PART II

Introduction

In this chapter, the first two research questions, those dealing with the areas for scanning and the variables for scanning, are discussed. To support the specific analysis, the first question is answered in terms of the questions which the managers identified as important, while the second answer is founded on the sources of information which they named.

What Are the Crucial Areas Which Must be Scanned to Allow Effective Decision-Making in the Motor Carrier Industry?

Introduction

By looking first at the decisions considered most important by the CEO's and managers in the 22 firms, and second by examining the areas for scanning mentioned specifically by the interviewees, a foundation was established for answering the first research question. All of the decisions and scanning areas mentioned by managers in these firms are covered, with the analysis taking place on the basis of previously established size categories. Data are abstracted from the analysis to develop a comprehensive conceptual model at the end of this section.

The Important Decisions

As Table 5.1 shows, some decisions had a universality that transcended size and other factors. The market expansion and pricing decisions were mentioned by managers in 18 and 20 of the firms respectively. Differentiating between categories of firms in these two cases was not a matter of the decision, but of the absolute magnitude of the resources affected by it. For the small firm, the CEO might have decided the rate for a particular commodity, route, or shipper. For the medium firms, the structure of the rates was a strategic decision, along with negotiations with very large shippers. Setting policies concerning meeting competitive prices, differentiating price to coincide with service offerings, and using price to penetrate markets required strategists attention in the large firms. Although these decisions differed, as noted, in the absolute size of the resources involved, the magnitude relative to the size of the firm did not vary significantly.

As for the market expansion decisions, similar statements may be made about magnitude. Where the CEO of a small or medium firm, particularly one operating in a limited geographical region with few terminals, might examine the opening of a new traffic lane or a single new terminal, the CEO and other strategists in a large firm were remote from such specifics and looked at states or regions, rather than lanes or terminals. In the firms with 48-state coverage, market expansion was more a question of finding ways to differentiate services nationally or regionally than one of adding to the geographic market,

Table 5.1. Decisions Considered Most Important by Motor Carrier CEO's and Managers in Small, Medium, and Large Firms from the 22 Firm Sample, June, 1982-February, 1984.

Firm Size	Important Decisions
eight small firms (AGOR less than \$20 million)	staying in business or not expanding markets or not specifying prices financing equipment purchases selecting personnel at all levels interlining and joining ventures
eight medium firms (AGOR \$20-100 million)	expanding markets by state, region staying in business or not structuring prices and arranging tariffs diversifying and recession proofing using debt financing avoiding unions and developing personnel relations
six large firms (AGOR greater than \$100 million)	defining the business integrating market areas diversifying segmenting markets selecting top managers identifying strategic informants

largely because the firm was likely to be serving almost every point in the nation already.

Small Firms

As the decisions peculiar to small firms were examined, the importance of private ownership became apparent. In six of eight small firms, the CEO was either the owner or one of a limited number of owners of the firm. Thus, the decision as to whether or not to stay in business was a crucial and immediate one. Under most circumstances, there were three alternatives facing the decision-maker--stay in business, close, or sell out. For two of the four CEO's who mentioned this as an important decision, the options were limited by the fact that they had union contracts. Because of the pension obligations associated with those contracts, it would have been financially disastrous to close and unlikely that they would be able to find buyers.

The three remaining decisions were important precisely because of the size of the firm. Due to the limited resources of a small firm, financing of equipment purchases was more difficult and the impact of financing proportionally more significant than for medium and large firms. By the same token, the selection of a driver might have measurable influence on the firm's performance. One driver alienating one large shipper might change the profitability of the firm for the year by a substantial amount. Joint venture decisions were primarily seeking means for participating in new markets by expanding the resource base while also sharing the risk. Joining with other small firms, these carriers would create a new corporate entity, target

selectively markets poorly served by large unionized carriers, and enter with lower costs and more timely and reliable service. Not incidentally, these new corporate entities also provided an avenue of growth for those firms which were constrained by union agreements. Since this strategy often involved serving highly unionized areas in the industrial North, no terminal openings were considered. Rather, contractual arrangements were made with existing facilities. Once an opportunity had been identified, the crux of the decision was with what other firms should the carrier participate.

Medium Firms

The CEO's of two of the eight medium carriers also mentioned the decision to stay in business or not, but their firms, in contrast to the two troubled small carriers, were highly profitable, privately held organizations with no union contracts. As a result, they were targets of offers to purchase, especially from large firms with weak positions in the regions they served.

Personnel relations and union avoidance were nearly universal concerns for this group. Because the ability to expand markets and grow in revenues and profits was seen as dependent upon the level of satisfaction among employees and the maintenance of the non-union character of the firms, CEO's in this group had wide acquaintance among employees at all levels of the firm, open door policies, and a serious attitude toward grievances. This is not to trivialize or ignore the management styles, personal backgrounds, and firm histories which also contributed to the adoption of these practices and attitudes.

Because the use of debt both enabled expansion in good times and threatened financial soundness in bad times, it was of particular importance to this group of carriers. Four of the eight borrowed and invested in economic upturns, while minimizing new borrowings and capital purchases during recessions. Three others had no debt, financing all expenditures from revenues and retained earnings. Following a successful policy from its past, one firm placed major purchase orders for trailers and trucks at the bottom of recessionary cycles, a practice which enabled them to prepare for the upswing and obtain low prices on vehicles. Because of the prices, payment came from operating revenues and the cost position of the business was maintained at a level below all of its major competitors.

Stimulated partly by their firm's successes and partly from an apparent entrepreneurial restlessness, the CEO's of six of these firms were actively seeking diversification. As the prospects for expansion in the trucking industry appeared to carry more threats--unionization and increased competition from large carriers for less-than-truckload traffic--than profits, truck sales dealerships, tire suppliers, restaurants, and other enterprises closely associated with the industry have drawn their attention and their investment capital. No other consistent patterns were apparent in these ventures.

Large Firms

Perhaps it was a reflection of strategic thinking, perhaps a vestige of the recent shift from truck-load to less-than-truckload emphasis, but the CEO of the largest firm in the sample stated that

his most important decision was defining the business. Due to the heavy influence of such a definition on diversification and market integration decisions, an enormous amount of information was required. Drawing from all functional areas and demanding the attention of every strategist, this may have been the most important decision involving the strategic information system.

Receiving an unexpected amount of emphasis were people-related decisions--not the general human or personnel relations decisions encountered in the medium firms, or the specific selection of drivers of the small firms' CEO's, but the choice of top managers and the identification of strategic informants. Surrounding themselves with the right people and finding the right person to ask about strategic decisions were prominent in the minds of five of the six large firms' CEO's. Other strategists within these organizations shared the same concerns, both in terms of their peers and their subordinates. With respect to fellow top managers, the general criterion for selection was expressed as "fitting the organization." With respect to strategic informants, it was simply "finding the right person to talk to."

That five of these six firms were publicly held and all were unionized probably influenced the degree to which top management selection was stressed over personnel relations. It may have been that union negotiations and the threat of labor problems were perceived as part of business as usual.

Summary

A vital dependence existed between what the motor carrier executives and managers considered to be their most important decisions and the areas which they regarded as crucial for scanning. To some degree, decisions given the most weight varied with the size of the firm, but other, somewhat related factors entered the analysis as well. Ownership of the firm (publicly held or privately held) and whether or not the firm was unionized also had a great deal of influence over the weight given decisions.

Scanning Areas Identified by Managers

After carefully analyzing the decisions which managers considered important, the scanning areas they chose come as no surprise. Inasmuch as these areas mirrored conditions at the time of the interviews, managers mentioned variables which they watched closely more often than broad categories for scanning.

Table 5.2 shows the environmental segments granted importance by the interviewees. As with the decisions, they are classified according to the sizes of the firms.

Small Firms

Competitive pricing, service offerings, unionization in markets for expansion, profit and loss statements, and government regulation at the state and Federal levels were foremost scanning areas for small firms. At the time of the interviews, pricing preoccupied the industry. Because shippers were asking and receiving discounts of

Table 5.2. Areas for Scanning Identified by Managers and Executives in a 22 Firm Sample of Small, Medium, and Large Motor Carriers, June, 1983-February, 1984.

Size of Firms	Areas for Scanning
small firms (AGOR less than \$20 million; 8 firms)	the economy competitors' pricing competitors' service offerings unionization of new markets profit and loss statements state and Federal regulations
medium firms (AGOR \$20-100 million; 8 firms)	competitors' pricing competitors' service offerings personnel attitudes financial markets costs and cost trends industry innovations large carrier activities
large firms (AGOR greater than \$100 million; 6 firms)	the economy competitors' pricing customer decision-making processes organizational response to strategy industry innovations

up to 35% off the class rate, service differentiation seemed to matter little, but carriers were nonetheless watching for successful instances of it in order to adopt the practices themselves. For non-union entities, the existence of a high level of union activity at the other end of a shipping opportunity meant involving already operating terminals located in the destination area, because of the threat of a union attempt to organize throughout the firm.

Profit and loss statements provided much of the financial data for decision-making, despite a multitude of technical inadequacies and reporting difficulties. Regardless of their limitations, these statements were widely used and accepted.

Since intrastate carriage provided much of the income base for at least half of the eight firms, state regulatory actions were of great interest and potential impact. As a defense, such regulation stands against the incursion of large carriers into still more segments of their markets. These carriers also monitor the economy to make their capital expenditure and market expansion decisions.

Medium Firms

The monitoring, generally informal, of personnel attitudes, the economy, competitive pricing and service offerings, financial markets, and industry innovations fits well with the decisions deemed important by the executives and managers. Where market expansion decisions in small carriers were often made at risk, with little prior information, managers in the medium firms drew on all of the scanning areas named for data. Relying more on data and less on intuition,

managers in these organizations emitted a keen awareness of the constraints placed upon them by large competitors, union organizers, and governments. Decisions, here, had less of the quality of the marauder's bold stroke, and more of the precision of the surgeon's incision.

Three of these eight firms had highly sophisticated, interactive, computerized costing systems, and two others were prepared to install similar systems. Consequently, costing and contribution margin analysis were emphasized over the profit and loss statement. One firm never employed terminal profit and loss statements, since its president and its chairman of the board preferred its managers to stress the effects of decisions on the whole firm, not on the individual business unit. The reliance on computerized costing and contribution margin system aided the effectiveness of this policy.

That such computerized decision aids affected the decision-making processes in these firms underscored a major point, one pervasive in the results of this study: there is a strong tendency for managers to monitor those areas which are easily monitored and to ignore the rest, regardless of how useful or important they may be. Through the implementation of the on-line systems for costing and contribution margin analysis, at least some of the areas which were previously discounted or subjected to arbitrary assumption were induced to yield data and information.

Large Firms

That managers in large firms also gave scanning areas which were topically related to their immediate concerns was undeniable.

Competition, uncertainty about the success of new strategies, general economic conditions, and service innovations drew the most managerial attention. Not to imply that the broad areas were not being scanned, but specific issues were cited more often than categories. It may be that these issues were omnipresent, in spite of their specificity.

A Summary Model of Areas to Scan

Given the specificity of the areas for scanning identified by the interview subjects, it was possible to develop a general model which incorporated their thinking, but in a broader, categorical sense. Two facets of this model were also used to aid in analyzing the answer to the second research question.

Since the SIS design process was defined as identifying areas for scanning, this mode, shown in Figure 5.1, was based on design. Essentially, the model describes three levels of influence upon the SIS design process, starting with the nature of the environment, passing through the principal actors in the environment, affecting the decisions and determining the decisions of consequence, and finally impinging upon the design of the strategic information system.

The Nature of the Environment

In this model, the nature of the environment was described in two dichotomous dimensions. First, was the dimension of time, which was either compressed or extended. With extended time, events occur over a long period and change is slow. Compressed time suggests circumstances under which events swoop into the collective consciousness

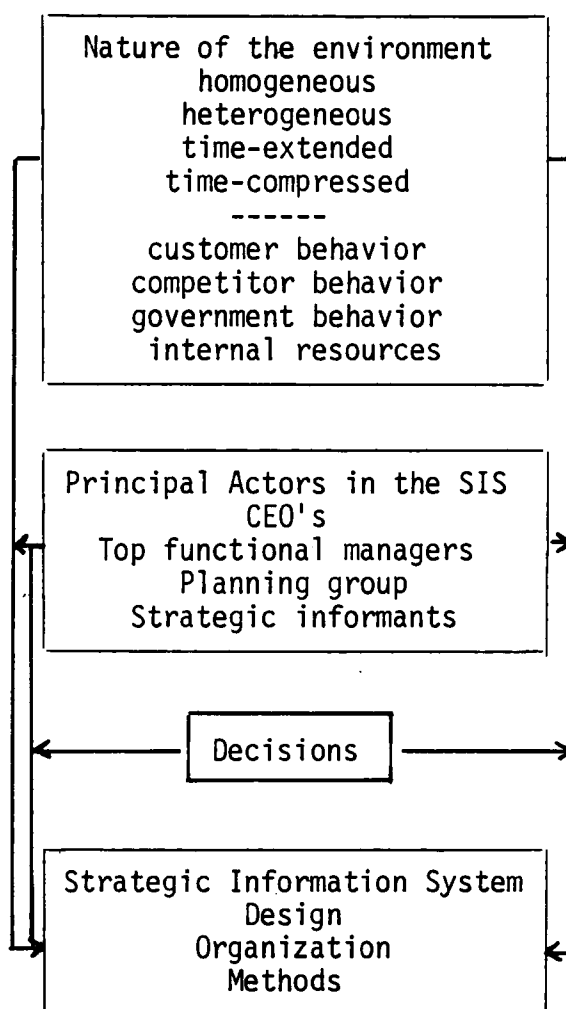


Figure 5.1. A Tri-level Model of Influences Upon the Strategic Information System.

and change is rapid. Second was the dimension of variety. On the one hand, the environment could be described as homogenous, having a low degree of variety. In essence, relatively few elements act crucially in this environment. On the other hand, a heterogeneous environment, one with high variety, contains many potentially enhancing or threatening elements. As defined by these two dimensions, the nature of the environment creates the context in which the principal actors must function.

The Principal Actors

Reducing the specific scanning areas to broader categories, the environment may be segmented along the lines of the behavior of principal actors in it. For the model in Figure 5.1, the crucial areas to scan for motor carriers were described as follows: (a) customer behavior, (b) competitor behavior, (c) government behavior, and (d) resources of the firm. Each of these areas is discussed in the sections which follow.

Customer behavior: Customer behavior was chosen as the term for motor carrier scanning because the shipper-only view was too narrow. From the standpoint of evaluating and purchasing motor carrier services, customers sit at both ends of the haul. Relying on receivers to specify their firms to shippers, some motor carriers actively sell their services to both groups. With receivers, the primary selling point was service, largely because shippers generally pay freight bills. To smaller carriers which concentrate on the

development of market niches based on high service levels, this was a particularly important selling approach.

These service levels are, in turn, based upon time-in-transit, low loss and damage claims, and ready access to equipment and drivers. Customers with a high need for timeliness, such as hospital suppliers, often relied upon the smaller carrier who provided less than 24-hour service between points in a narrow geographic area, usually covering a distance of 500 miles along major highway arteries. So that the customer can load the vehicle at his or her convenience, these carriers also allowed trailers to sit at a large customer's dock for several days. Generally showing a loss and damage claims rate of less than 3%, these carriers also responded to requests for late night and weekend service--for additional fees.

By contrast, the large carriers sold a clean dock. Wherever a customer wished to send goods, these firms had the authority and ability to meet the destination requests for any location in the contiguous 48 states. As long as the move was interstate, these firms could claim to go to any point in the nation. They offered a reasonable level of timeliness, average levels of loss and damage, and five-day-a-week standardized access to equipment and drivers.

Falling between the large and small firms in more than just size, the medium firms offered the clean dock with a limited region, lower rates than the large carriers, and somewhat less flexible service than the small carriers.

Regardless of size, the question for any carrier was how customers responded to the service approaches, and whether or not

the carrier in question met requirements well enough to have a positive influence on the customer/decision-maker. In dealing with very large shippers, the carrier might be confronted by company policies created at some distant headquarters which did not adequately account for the local situation. It then became a question of whether or not the traffic people in a particular area were willing to act against those guidelines in order to meet service objectives.

In monitoring customer behavior, the key element was the response to the carrier's price and service offerings, as well as to extraordinary offerings like customer entertainment and reciprocal agreements. What effect did a price change have on a particular carrier? For shippers, who generally paid freight bills, it was usually strong. To receivers, who did not pay directly, the response was likely to be delayed until the change was passed through by the shipper. While shippers were likely to be both price and service responsive, receivers were more likely to be service responsive.

Due to the derived nature of transportation demand, those factors which affect customers affected carriers as well. Factors external to the customer-carrier relationship, such as government policies and competitors' activities, interacted with both groups.

Competitor behavior: While other carriers may be the source of some hostility in the environment, they may also show the way to survive in it. First, competitive actions may alter the firm's relationship with its customers. Second, their actions may be a source of new ideas.

Having relied for many years on customer loyalty, some carriers in the study assumed that it would continue beyond deregulation, despite the recession and the discounts which were offered by their competitors. At least one carrier failed because of this belief. Although managers knew about the discounting, they did not monitor its effects on their revenues or respond quickly enough to their belated realization.

Not only the historical forms of competition threaten any particular firm, but also carriers whose activities were once restricted to narrow geographical areas now operate far afield. Neither should other modes of shipping be ignored. Small, high-time service carriers compete with air freight in hauls of less than 300 miles. At these distances, because of the ability of motor carriers to provide door-to-door service and flexible schedules, motor carriers may have an advantage in the markets. In high density traffic lanes, railroads can also provide significant competition. Trains provide 12-hour service between some major cities, terminal-to-terminal, and have lower costs even at these levels of service.

Probably the most important point to be made about monitoring competitive behavior in the deregulated environment is that managements cannot afford complacency. Failure to respond to competitive activity has hurt some carriers, including those in this study. Carrying forward false assumptions about the pace of change and its competitive effectiveness, a carrier may shortly find itself listed with the dinosaur and the nickel soft drink.

Government behavior: Not only did the federal government regulate the industry for 45 years, and then deregulate it in 1980, it also created a relative structure for competition between the modes of transportation. Within the industry, state level regulation has tended to defend the smaller carrier from the large, thus creating a competitive structure in each state, but one which may be subject to change.

Because of the deregulation at the Federal level--and at the state level in Florida--the dependence on interlining has changed, as has the relative emphasis on truck-load over less-than-truck-load carriage. Where, prior to deregulation, small carriers drew much of their business from interlining with large carriers, now they depend on line-haul movements. Where, prior to deregulation, large carriers derived 75% of their business from truck-load traffic, now they haul primarily less-than-truck-load traffic. Other regulations and laws may have equally dramatic impact, necessitating a strong emphasis on the monitoring of government activity and the analysis of its potential impact.

Considering the enormity of these effects, the monitoring--and influencing--of government behavior was clearly of vast importance to the carriers in the study. Because smaller carriers actively cultivate state-level politicians, for example, large, multi-state carriers would probably have difficulty gaining significant authority through application. Should other states deregulate, as has Florida, many of these smaller carriers would have to alter their strategies significantly.

Resources of the firm: The resources of the firm may be classified as human, financial, or physical. Since these three classifications are highly interdependent, a firm must have a certain amount of one in order to obtain a given amount of the others. With human resources, financial resources may be generated to purchase physical assets. In fact, any one resource has the potential to be used to gather the other two.

Anyone employed by the firm--drivers, supervisors, managers, sales people, dock workers, and executives--is included among the human resources, along with anyone who is hired by the firm. Among these are suppliers, consultants, outside auditors, and government officials who are assigned to work with the industry. So long as the firm is able to control these resources for the benefit of the owners, it does not matter whether they are owned or rented.

In this sample, privately held firms seemed to deal with resources more creatively and more directly for the benefit of the owners. By leasing fully depreciated assets from stockholders, firms paid out earnings which were sheltered from business taxes. The creation of additional entities as a strategy for growth was more prevalent among small firms than medium or large, for privately held than for publicly held. Perhaps this was the result of the size differences and closer scrutiny of the large firms by government agencies and labor groups.

Of all the resources of the firm, the most important is probably the ability of managers to use the firm's other resources effectively in the service of the objectives of the organization. Skill at negotiating, the capacity to see the firm in perspective

to the industry, the owners, the levels of government, and the ability to work with these groups are characteristic of the most crucial assets the firm can master.

Decisions

As the behavior of the principal actors in the firm's environment are influenced by its nature, so are the decisions which the managers must make bound to the behavior of the actors. The very decisions which the interviewees identified as crucial were important largely because of the activities of government, competition, customers, and the firm's resources. When the nature of the environment changes or the principal actors respond differently to it, then the character of the important decisions will change as well.

When the variables and sources are discussed in answer to the second research question, the decisions as categorized by size of the firms are used, along with the broad environmental categories, to create an analytical matrix.

Strategic Information System Design

Ultimately, the influences reach the strategic information systems design, which requires CEO decisions about the relative weights to be given to particular areas for scanning. As he or she makes such a decision, the influences of the environment, actors, and decisions must be taken into account. Other related factors must also be considered, such as the availability of data, the variables which are most useful in scanning, and the sources of

data. These latter factors are considered in answering the second question.

What Variables Are Used by Motor Carrier Managers
to Scan Each of the Areas?

Introduction

Drawing from the decisions cited and the environmental scanning areas described in the previous section, this question is answered by analysis of the sources of data mentioned by the managers in firms of each size, along with the variables. This analysis is presented in tabular matrices with the environmental segments and decisions as the two dimensions.

Sources of Data

In many respects, the sources of data in each segment of the environment were the same for all firms and all decisions. Between customers, competitors, government officials, consultants, and managers within the firm, virtually all ultimate sources of data were covered for all levels of analysis. Beyond this, the precise media from which the decision-makers drew their varied greatly. The tables which follow reflect direct media sources, rather than ultimate sources of data. For example, if a large firm employed survey research on customers, the survey, not the customers, is treated as the source of data.

Sources for Small Firms

In Table 5.3, the key decisions given by the managers in the small firms and the broad categories of the environment are used to classify the sources of data used by these managers. The size of the firms influenced the degree to which data were drawn from ultimate sources of data. Perhaps the most frequently used sources of information about customers were the customers themselves. In addition, customers provided much data about competitors and the need for additional resources in the firm. Employees of the firm, such as drivers and sales people, also gave much data about competitors and customers. One CEO said that many of his employees, including himself, had long ago mastered the art of reading freight bills upside down on the desks and clipboards of shipper managers.

In gathering information on potential market entrance, interlining, and joint ventures, potential customers became primary sources. Here, the apparent tactic was to blanket the potential areas of customer groups with sales people and managers, who contacted future customers directly. Serving as a means of informing prospective shippers as well as a means of finding out about them, this flooding immediately preceded the opening of new terminals and lanes.

Sources for Medium Firms

Using the same analytical categories as for the small firms, the data sources cited by managers in the medium firm are shown in Table 5.4. The first distinction between the medium and small firms which becomes apparent from this analysis is the presence of the MIS

Table 5.3. Sources of Data in Broad Categories of the Environment as They Related to Strategic Decisions Identified by Managers in Eight Small Motor Carriers, June, 1983-February, 1984.

Decisions	Environmental segments			
	customer behavior	competitor behavior	government behavior	resources of firm
Stay in business or not	customers drivers	customers competitors drivers	regulators legislators	managers drivers bankers
Expanding markets or not	customers potential customers drivers	competitors drivers	regulators legislators	managers bankers
Specifying prices	customers drivers reports	customers	regulators legislators counsel	managers
Financing equipment purchases	customers potential customers drivers			managers bankers
Selecting personnel	customers	managers competitors	regulators	managers
Interlining joining ventures	customers		regulators	managers bankers

Table 5.4. Sources of Data in Broad Categories of the Environment as They Related to Strategic Decisions Identified by Managers in Eight Medium Motor Carriers, June, 1983-February, 1984

Decisions	Environmental segments			
	customer behavior	competitor behavior	government behavior	resources of firm
Staying in business or not	customers MIS	customers competitors managers	legislators regulators outside experts	managers bankers MIS
Structuring prices and arranging tariffs	customers MIS	MIS drivers customers managers	regulators	managers
Diversifying and recession-proofing	potential customers	customers MIS	regulators legislators	managers bankers MIS
Using debt financing				bankers owners managers
Avoiding unions and developing personnel relations	customers	competitors managers	legislators outside experts	managers drivers

as a stated source of data in several segments of the environment and for several decisions. Along with the customers themselves, it was one of only two sources mentioned by these managers. To a degree, this may reflect the nature of this sample, which included three firms with operational, on-line data systems readily available to managers. It also suggests that there was greater reliance by strategists on managers, regulators, and outsiders who were closer to ultimate sources of information than the decision-makers themselves. Competitors appeared here, as well as in the small firms, as major sources of information about themselves. As they moved into markets, not only were their activities visible, but also the managers and other employees talked about programs to one degree or another across firms' boundaries.

Due to the difference in firm size, more attention was paid to Federal level regulation by these firms. Consequently, the members of the Interstate Commerce Commission and Congressmen were mentioned as data-providers by several of these managers. While still dealing with primary sources, the level had moved from the state to the Federal level in terms of regulatory concerns. This is in keeping with the diminishing emphasis given to intrastate regulation as the size of the firm increases.

The appearance of the outside expert as a data source also deserves some mention, especially since he or she was mentioned only with regard to the behavior of the government. Because of the recency of deregulation at the time of the interviews, new interpretations and rulings were still being made. Much remained to be

clarified and top managers from these firms hoped both to learn and to influence these regulatory decisions. Hence, there appeared to have been many instances of personal meetings between top regulators and strategists in the medium firms.

Sources for Large Firms

While adding only one new category of data source--data services--Table 5.5 seems to be filled to a greater extent than the previous two tables. Two explanations for this phenomenon suggest themselves. First, the managers of the larger firms use more sources of data in the process of making each strategic decision than do managers in the other two groups. Second, the managers in the large firms were more aware than their counterparts of the information gathering process, and hence the sources of information. Since the decisions within each of the firms were interrelated, the latter seems the more compelling reason. Also, the degree to which formal reports were used in the large firms may have heightened these managers perceptions of sources.

The use of outside experts as sources of data was greater for large firms than for the other groups. Using primarily surveys, research firms were hired to assist in the general assessment of the market. In-company resources were more frequently employed when highly specific questions were to be answered in these areas. To some extent, the use of data services operated in the same way. These services were used for questions more remote from the industry and the particular firm, such as those requiring general economic

Table 5.5. Sources of Data in Broad Categories of the Environment as They Related to Strategic Decisions Identified by Managers in Six Large Motor Carriers, June, 1983-February, 1984.

Decisions	Environmental segments			
	customer behavior	competitor behavior	government behavior	resources of firm
Defining the business	outside experts customers managers	managers competitors data services	legislators outside experts	managers MIS investment bankers
Integrating market areas	customer traffic research	competitors data services	regulators	managers MIS
Diversifying	potential customers customers	outside experts	regulators managers counsel	managers MIS investment bankers
Segmenting markets	customers managers outside experts		regulators	managers MIS
Selecting markets	customers	managers data services MIS competitors	regulators	managers MIS
Identifying strategic informants	customers managers	customers managers	regulators legislators	managers

data, while internal analyses were more likely for those data which came directly from the industry or from the firm's customers.

Only non-quantitative sources were employed in the search for strategic informants. From the interviews, reputations follow certain individuals--with probable justification--just as they followed gun-fighters in the American Old West. To isolate the right person to talk with about a particular issue apparently required talking with yet another group of people. These could be any credible individuals who were well acquainted with the industry or with the issue who also were willing to assist.

Variables for Scanning

After considering the sources from which the strategists in the sample drew their data, the nature of the variables which they used for scanning becomes more understandable. The tables in this section relate these variables to the decisions discussed previously. As with the decisions and sources, the variables shown are those which were identified by the managers during the interviews.

Variables Identified by Managers in Small Firms

In creating strategies for their firms, it was clear that the CEO's and managers of small carriers relied primarily on qualitative variables to aid in scanning the broad environmental segments. Lacking quantitative data bases and displaying a strong preference for person-to-person contacts, the managers gathered most of their data from statements made by principal actors in each segment of the

environment. Converting these data into information was primarily a process of interpreting the statements based on personal or company experiences. These variables are summarized for small firms in each broad environmental category in Table 5.6. Based on the environmental categories, the variables are discussed in the sections which follow.

Customer Behavior

Regardless of the decision to be made, data about customers came primarily from the customers themselves. No adequate information could be produced in the absence of managerial judgments which included assessments of the veracity of individuals and the likelihood that individuals would give a complete picture of circumstances which affected the relationship between the customer and the firm. In effect, the historical correspondence between customer statements and customer actions becomes a factor for weighting the value of new data provided by a particular person. This process took place only in outline form, and was effective only because there was frequent contact between the strategists and the customers.

Competitor Behavior

In many respects, the variables which were used to monitor competitive behavior caused the process to resemble that of gathering tactical military intelligence while on patrol. First, the statements of customers (natives) were used, as was discussed in the preceding section. Second, actually seeing the competitor (enemy) in the market--the salesperson at the customer's office or the truck at the

Table 5.6. Variables for Monitoring Broad Categories of the Environment as Related to Strategic Decisions Identified by Managers in Eight Small Motor Carriers, June, 1983-February, 1984.

Decisions	Environmental segments			
	customer behavior	competitor behavior	government behavior	resources of firm
Staying in business or not	traffic levels; cust. stmt. of purch.	visible presence in market; P&L	GNP; bus. cycle stage; regulatory trends	P&L; interest rates
Expanding markets or not	stmts. by customers; requests for svc.	interlines; P&L; cust. stmts, on price & svc.	rulings and decisions	P&L; intuition
Specifying prices	stmts. on price; purchase decisions	apparent prices; published prices	restrictions	
Financing equipment purchases			GNP; inflation rates	interest rates; current funds & credit
Selecting personnel	complaints comments	notable efforts	labor regulators	managers; comments
Interlining joining ventures	estimates of potential			levels of util.

loading dock--was a vital variable, although questionable as a foundation for making a quantitative forecast. Despite having lost some significance due to deregulation, the third variable for this part of the environment was the published rate (strength pronouncements), which maintained some importance as a measure of competitive activity. Finally, the fourth variable was the apparent success or failure (gains and losses of territory) of particular services (tactics), technology (weapons), and pricing strategies (attacks) in the marketplace, all of which relate back to customer statements about them.

Government Behavior

For small firms, the state government had as much, or perhaps more, relevance than the Federal government. Decisions made by public service commissions may have had as much impact as those made by the Supreme Court. Monitoring this behavior, like scanning the customer's behavior, came down to listening to statements by regulators and evaluating them in the context of managerial experience. Not that GNP, the business cycle, and inflationary trends had no meaning for these firms, but as indicators of government behavior, they were of little direct import. Still, they were watched and did influence some decisions.

Resources of the Firm

Perhaps the only quantitative-appearing variable widely used by CEO's in the small firms, the profit-and-loss statement was mentioned by all strategists in this group as important. In every case it also required some explanation, because decisions were made in

these firms on the basis of being able to translate profit-and-loss entries into cash flow and into increased wealth for the owners, who were frequently the strategists of the firm. The profit-and-loss statement showed the level of activity and possible gains, while interest rates, availability of credit, and levels of equipment utilization reflected the expectations of major resource providers--like banks--about the future of the firm.

Variables Identified by Strategists in Medium Firms

The variables used by managers in the medium firms were radically more quantitative than in the small firms. Examining the degree to which these firms relied on their computers from the operational level upward, the numerical support given to all decision-making was substantial. As a result, revenue levels and contribution ratios by segment and lane replaced, to some degree, the qualitative statements of the customers that dominated the variable inputs in small firms. Each broad category of the environment and its related variables is discussed in the sections which follow. For medium firms, the variables are summarized by category in Table 5.7.

Customer Behavior

Where small firms relied on customer statements and managerial judgments to assess a potential market, managers in medium firms, because of access to better and larger data bases, were able to evaluate historical purchases of service and trends by industry. Even profitability was evaluated by those firms which employed

Table 5.7. Variables Cited for Monitoring Broad Categories of the Environment as They Related to Strategic Decisions Identified by Managers in Eight Medium Motor Carriers, June, 1983-February, 1984.

Decisions	Environmental segments			
	customer behavior	competitor behavior	government behavior	resources of firm
Staying in business or not	revenues & profits; trends in cust. ind.	relative performance on multiple criteria	rulings & trends	personnel attitudes; profits & trends
Structuring prices and arranging tariffs	purchases; traffic patterns; elasticity	competitors' prices	rulings by state and federal Governments	operating ratio by segment
Diversifying and recession proofing	customer cycles; opportunity analysis	successes in new businesses	regulatory rulings-- ICC, SEC	access to funds
Using debt financing	equipment use level			profit margins; interest rates
Avoiding unions and developing personnel relations	customer response to contact employees	successful practices	labor regulations	union activity; personnel attitudes

interactive systems on appropriate hardware. Availability of data and analytical tools probably influenced this level of quantitative variables, along with managerial preferences for this type of analytical assistance. Without question, equipment utilization factors such as lane density and direction influenced these managers' assessments of customer behavior as well. Since drivers and sales people were the primary contacts with customers, shipper and receiver responses to these individuals were also crucial in making personnel decisions.

Competitor Behavior

In one firm, the results obtained by competitors on over 200 operational variables were used to evaluate the firm itself and to gather clues for improving operations. Competitive prices, price structures, innovative features in services, diversification efforts, and personnel policies were subject to observation and provided ideas for changing the strategic direction of the firm, or at least evaluating it. As managers moved from firm to firm, some ideas traveled with them. Like the small firms, the medium firms relied upon scouting reports and qualitative data for the scrutiny of competitor behavior. Certainly, it is difficult to hide activities in an industry which holds out services to the general public, so that, even with deregulation, changes in motor carrier operations were highly visible.

Government Behavior

From a qualitative standpoint, the laws and rulings were in and of themselves variables, as were the degree to which regulations and legislation were enforced. Trends and analyses of the impact of these rulings on profits, market extension, and other measures of success could be gained after developing an understanding of the qualitative variables, factors which touched decision-making at all levels and in all areas of each firm.

Resources of the Firm

Two important decisions were heavily influenced, in this group of carriers, by attitudinal variables. Although it is certainly possible to attempt to quantify employee attitudes, this was not the practice in these carriers. Rather, attitude evaluations were based generally on the subjective assessments of supervisors, managers, and the strategists themselves. Using open door policies and other techniques for increasing direct contact with employees appeared to help both the tracking of this qualitative variable and the decision-making which was affected by it. In quantitative terms, operating and contribution ratios by segment, revenue and profits by segment, the availability of funds, and interest rates all had implications, particularly for those decisions that directly concerned approaching new markets--debt structure, pricing, and diversification.

Variables Identified by Strategists in Large Firms

As was expected, the use of quantitative variables was greatest for the large firms. Among the largest firms, many numbers were employed, especially in making market decisions related to segmentation, integration, and selection. These variables, along with many qualitative factors, are shown in Table 5.8. As with the other two groups, they are discussed in sections which deal with the broad environment categories.

Customer Behavior

Where in the small firms, customer behavior was assessed largely through qualitative comments, in the large firms it was the subject of much numerical analysis. Deriving preferences for reliability, timeliness, and price from market surveys, the large firms used both internal planning groups and specialists in the field of marketing research for customer studies. These studies had the potential for affecting any of the firm's strategic decisions, but were of greatest importance in developing criteria for segmentation and definitions of the business. From qualitative statements, the identity of strategic informants was deduced. In this regard, the CEO of the largest firm was no different from the CEO of the smallest. Reliance upon the statements made by an individual produced a record of assistance that provided a foundation for future decision assistance. Put simply, informants developed track records in certain areas, although such a record was always qualitative. Traffic and lane analysis for volume were important to market selection, which was also closely

Table 5.8. Variables Cited for Monitoring Broad Categories of the Environment as They Related to Strategic Decisions Identified by Managers in Eight Large Motor Carriers, June, 1983-February, 1984.

Decisions	Environmental segments			
	customer behavior	competitor behavior	government behavior	resources of firm
Defining the business	profits by segment; survey data	market share	regulatory change	profits; efficiency factors; costs
Integrating market areas	profits by segment	presence; prices; services; share		backhaul; efficiency factors
Diversifying	stage in life cycle			management skills
Segmenting markets	survey data; comments	prices; successes		use of equipment; management skills
Selecting markets	traffic types; lane volume			
Identifying strategic informants	statements; performance	performance	expertise	expertise

tied to market integration decisions. Finally, the stage of an industry's life cycle was considered a critical variable in evaluating it as an area for diversification.

Competitor Behavior

Market share, prices, and profitability were the important quantitative variables for evaluating competitors. By looking only at those firms who were regarded as direct competitors, which meant the 15 to 25 largest firms in the industry, depending on which firm was doing the analysis, a reasonable estimate of market share was possible. The qualitative variables of presence, performance, and successes were also used, with much the same import albeit on a grander scale than in the small and medium firms. The analogy of intelligence gathering holds for large firms as it did for small. While the efforts may be more organized, the qualitative examination of competitors seemed to provide the framework for evaluation of the competitors in quantitative terms, just as it did for medium and even some small firms.

Government Behavior

Although many sources provided information on government behavior, the variables on which these sources commented were quite limited in number. Regulatory changes and the expertise of regulators as potential strategic informants were crucial, along with legislation which would affect regulations. In Table 5.8, only regulatory change and expertise of regulators are shown, and then only in relation to two principal decisions, the definition of the business and the

identification of strategic informants. This is because the definition of the business affects and precedes all of the other decisions, while the identification of informants is only slightly related to them. Thus, all of the decisions were covered with respect to government behavior by only two variables, both essentially qualitative.

Resources of the Firm

In contrast to the variables used for monitoring the government, most of the devices for scanning the resources of the firm were quantitative. Levels of productivity and utilization, profitability, backhauls, and other numerical values were used in relation to most decisions at the strategic levels of these firms. From a qualitative perspective, the skills of the managers were important to diversification and market segmentation decisions. Once again, these variables were placed in a context of non-quantitative variables that related to other categories of the environment. The qualitative variables in these firms seemed to be used to structure the framework in which the quantitative variables were interpreted.

Summary

In answering this question, both sources and variables were studied in order to show the contrasts between the groups of firms. Where small firms relied primarily on human sources and qualitative variables, the medium and large firms used human, analytical, and technological sources for both quantitative and qualitative variables.

The smaller firms, the closer the strategists were to the immediate sources of data, and the less aggregated the data were when used in decision-making. The fundamental relationship between firms of all sizes and the kinds of decisions that they made had only a minor effect on the nature of the variables employed by strategists in the three groups.

Although customers were the primary source of data about themselves, the statements made by a single customer were important to the CEO's of small firms. For large firms, the analogous data came from survey responses as analyzed by marketing research firms and internal planning groups. Not surprisingly, the medium firms represented a compromise between the two, relying on internal analysis of aggregated customer data and statements made directly by shippers and receivers.

Only in analyzing government behavior were the firms in all three groups looking at essentially the same variables in the same basic fashion. The regulatory changes, the legislation, and the reputations of regulators were all qualitative--and monitored by firms of all sizes. One difference was the relative importance of changes in state regulations and laws. On one hand, they were vital to this group of small firms. On the other hand, they were of little importance to most of the medium and large firms.

The manner in which the firms watched one another included a mixture of qualitative and quantitative factors. Market share, prices, and market extent were the numerical factors, while presence, successes, and performance were the qualitative factors. Large firms were able

to make better use of the quantitative variables than the small and medium firms. Data were apparently more readily available on the competitors in the large firms' markets.

Personal knowledge of all details of the firm's resources was the hallmark of the CEO in the small firm group. Reports were relatively few, but acquaintance with the numbers which were important to the carrier was high. They affected all decisions in some manner, but were not necessarily stated easily. By contrast, both the medium and large firms used a multitude of reports to assess the state of internal resources. The quantitative, despite its volume, seemed to be subordinate to the qualitative in large and medium carriers, as well as in the small.

Chapter Summary

In this chapter, the first two research questions were answered. Discussion of the first question incorporated the areas for scanning within the framework of the important decisions identified by the managers in the sample. The decisions were developed for each category of firm, and scanning areas identified by the managers were used to construct a model of the environmental impact on SIS design. Both sources and variables were placed in the context of decisions and environment in each of the three categories of carriers in order to answer the second question.

CHAPTER 6

ANALYSIS OF RESULTS: Part III

Introduction

In this chapter, two of the basic research questions are answered. The first deals with the degree to which strategists in the motor carrier industry are satisfied with the scanning processes as they currently exist within their firms. Because this question tended to produce all affirmative answers, an additional question was introduced regarding the information which the strategists would like to have, but find difficult to obtain. The second question deals with the integration of the computer into the strategic information system. Since computers are expected to assist management decision-making, the degree to which they contribute to the strategic process is crucial to system design and methods. All analysis in this chapter is performed with qualitative tables and brief numerical tables.

Do Those Responsible for Strategic Decision-Making Feel Satisfied With the Current Scanning Process?

To answer this question, a surrogate question was posed--what information do you wish you had that you cannot get, or get only infrequently and with difficulty? This approach was necessary because all of the CEO's, when asked if they were satisfied with the

current process, answered affirmatively. Yet if managers were questioned about information which they would like to have, but cannot get, then differences between firms were apparent, as well as discrepancies between where most firms were and where their managers would have liked them to be in the generation of strategic information. Tables of these perceived information needs are shown and discussed for each size category of firm in the sections which follow.

Small Firm Satisfaction

Among the size categories, strategists in small firms indicated the least satisfaction with their information gathering capabilities. Six of the eight firms mentioned at least one area where data were insufficient for decision-making. Of the two remaining firms, one CEO stated that he did not feel a lack of information, but that available information lacked timeliness, while the other attested to an information overload.

In Table 6.1, the primary statements about information gaps within small firms are shown, ranked according to the number of firms which mentioned each one. The total exceeds the number of firms in the group because some strategists identified more than one category of missing information.

On the basis of CEO statements, the most frequently encountered absence was of internal data on LTL, direct labor, and terminal costs. They appeared to be a by-product of deregulation and the economic downturn, which placed such intense pressure upon prices in the industry. To determine rates, these managers felt that they needed

Table 6.1. The Frequency with Which CEO's of Eight Small Motor Carriers Mentioned Strategic Information Needs, June, 1983-February, 1984.

Statements About Information Needs	Number of CEO's
need more information on internal costs-- LTL, direct labor, and terminal	5
need for information on competitors' prices and strategies	4
information adequate, but lack timeliness	2
cited information overload	1
Total	12 ^a

^aTotal exceeded eight because four firms cited both of the first two categories of information needs.

to know much more than they did about costs. Since many troubled competitors appeared to be pricing below costs, even below variable costs, the strategy makers in these firms were not sure when to meet price and when to reject traffic as uneconomic.

Four of these five firms also sought more information on competitive prices and strategies. Perhaps this was a reflection of an information shortage and was also the result of deregulation. Under regulation, managers were able to gain much of the data now missed simply by attending rate bureau conferences. The information value of these conferences has diminished to the point that many firms do not even send representatives to meetings. Added to this was the strategic uncertainty induced in the managers interviewed about their own firms in the new environment. It was no longer easy to answer the question, "What would I do if I were in my competitor's situation?" because they were doubtful about their own activities.

In the firms where the CEO's indicated adequate, but untimely information, the computer systems were in the developing stages. These individuals each had a well-defined notion of the information that they used to make particular decisions. Even in the absence of sophisticated electronic assistance, they received what they wanted, including all of the costing data that they felt were useful. But the production of these data were slow, sometimes causing a delay in responding to customer requests for rate quotes and new services.

Where others saw lack of data, one CEO found too much. Apparently preferring an almost purely intuitive approach to decision-making for the firm, this individual all but scorned the computer printouts

and other reporting data provided to him. There was some suggestion that too much routine decision-making fell to the CEO in this firm, causing him to feel harried and to be the recipient of too many communications.

Medium Firm Satisfaction

Comparatively, CEO's and other executives in this group did not appear to feel information needs as keenly as those in the small firms. Because several firms in this group appeared to engage in a high level of data gathering and processing activity, these results may not be easily generalizable to other firms of similar size.

Table 6.2 shows the concerns about information stated by the executives in the eight medium firms in the study. Since many of the problems afflicting managers in the small firms had apparently been solved in these organizations, the character of the information needs that they stated was different, with most related to specific operational or strategic decisions. Also notable in this category was the degree to which managers within a particular carrier mentioned the same information need, and the fact that each management group cited only one need.

As with the small firms, costing information was one of the most common types of missing information. But the medium firms differed in that their managers believed the knowledge of LTL costs to be adequate. Other costs, such as terminal costs, which were

Table 6.2. The Frequency with Which CEO's of Eight Medium Motor Carriers Mentioned Strategic Information Needs, June, 1983-February, 1984.

Statements About Information Needs	Number of CEO's
need cost information on budgeted expense items other than LTL costs	2
need information on potential govern- ment activities--anti-trust and further deregulation	2
need data for balancing load factors in both directions	2
need to know more about trends in shippers' industries	1
need analytical techniques which communicate with line managers	1
Total	8

related to line items in budgets, were needed in order to further rationalize the pricing structures employed by these firms.

Although deregulation seemed somewhat distant even when viewed narrowly as the passage of a single law, the ramifications of that event were still uncertain at the time the interviews were conducted. Where the industry had been largely immune to anti-trust prosecutions, the Motor Carrier Act brought in the possibility of Justice Department attention. The degree to which anti-trust laws would be enforced was of particular concern to some carriers in this group. Some managers also expressed a desire to see some return to regulation, despite the unlikelihood of such an occurrence.

Because the level of equipment utilization greatly influences profitability in the motor carrier industry, the stated need for more data on load-balancing traffic was expected. Where a small carrier may be able to solve most of its balancing problem by developing a relationship with a limited number of shippers who provide regular return loads, the complexity and extent of medium carriers' coverage made this much more difficult from the standpoint of both operations and information.

Closely related to the balancing problem was the need to know more about trends in the key shippers' industries. In the firms which mentioned this as the primary information concern, a few very large shippers made up as much as 25% of the firm's business. As a consequence, any negative or positive trends which could be anticipated had the potential to greatly alter the success of the carrier.

Finally, one firm, whose marketing and information system vice-president was highly quantitative by education and preference, mentioned the need for analytical techniques which would not only bring data into a technically manageable form, but also into a form which could be understood by motor carrier managers at the operations level. Most were not trained to use linear programming and integer programming, for example, which were sometimes used by this firm in analysis.

Large Firm Satisfaction

The managers and executives from the six large firms mentioned few information needs. In fact, CEO's in three of the firms said that they experienced information overload. Table 6.3 shows the types of data which they considered both potentially useful and difficult to obtain, even though the total amount of information and data reaching them was too great.

Since the managers who complained of information overload also referred to at least one category of need, this suggested that the overload was general, while the need represented relatively specific gaps in available data. The information needs reflect the changes which resulted from deregulation. As with other groups in the sample, managers and executives were accustomed to having competitive pricing information readily available under regulation. Not only that, relatively little customer data were needed under the quasi-monopolistic conditions under which the industry operated for 45 years.

Lacking mechanisms for gathering data on these two primary segments of the environment, in one case because the data were not

Table 6.3. The Frequency With Which CEO's of Six Large Motor Carriers Mentioned Strategic Information Needs, June, 1983-February, 1984.

Statements About Information Needs	Number of CEO's
need competitive pricing information	3
need information about customers	3
suffer from information overload	3
Total	9 ^a

^aTotal exceeds six because some CEO's mentioned more than one category.

needed and in the other case because the regulatory machinery provided a data-gathering system, the perception of needs in these two areas was apparently heightened. That which was once available was abruptly absent, and that which was once unnecessary was suddenly crucial.

One specific aspect of customer information which two carriers mentioned was about the preferences and behavior of the economic decision-makers in large shippers, as opposed to the technical decision-makers. In effect, what influences the shipper's vice president or president when he or she makes a decision which might affect carrier choice was of interest, rather than what influences the choices made by the distribution manager alone.

Summary

Clearly, the Motor Carrier Act of 1980 changed the perceptions of what managers needed to make good decisions for motor carriers of all sizes. Small carriers experienced information gaps which were broader than in the other groups. With fewer slack resources to dedicate to information and data related tasks, this may not be considered surprising. The expressed needs for more information in all environmental categories suggested that current strategic information systems are less than completely satisfactory to the managers, despite their assertions to the contrary.

While most small firms' CEO's desired to have more information on internal costs and competitive prices, one CEO from this group complained of information overload, as did half of the CEO's in the large firms. In all size categories, managers seemed to be making

the distinction between the number of reports and printouts that crossed their desks and the amount of useful information which they received. Overall, the consensus was too many of the former and not enough of the latter.

To What Degree Are Firms' Computer Systems Integrated Into the Strategic Information Systems?

Introduction

Considering the range of firms in the sample, it is no wonder that diverse answers were found to this question. Where managers in one firm might have no computer and no interest in one, in another the smallest decisions called for detailed analysis. On one hand, the size of the firm was the most overpowering influence on computer integration. On the other hand, it would be a mistake to overlook the impact of the nature of the computer system and the decision-making style of the managers in the firm. In the sections which follow, tables are used to relate these factors to the question of computer integration for each size category of firm.

Small Firms' Computer Integration

Because four of the eight firms in this group had no computer at all, the question had to be asked in terms of plans for computer purchase and use. Two of the four firms had no intention of purchasing data processing equipment, while the other two had placed orders for hardware which they had not yet received. One firm expected

delivery the day after the interview was conducted. As for the intended functions of the new equipment, managers in both firms stated that payroll accounting would be the first function to be automated, while customer billings and accounts would be next.

Table 6.4 shows that three of the firms which had computers used them for routine, operational purposes. In fact, payroll accounting and shipment recordkeeping were the primary functions for which their equipment was used. Computer-generated reports in these firms included profit-and-loss statements on a monthly basis, monthly traffic reports by shippers, and mileage reports for taxes. Some of these documents may have implications for strategic purposes, but none was clearly dedicated solely to such use.

Standing out in this group, one firm conducted computerized traffic lane analysis, developed an on-line LTL costing methodology with the help of an outside consultant, and had a well developed formal strategic planning process. Four of this firm's top managers made regular use of computer-generated analysis, especially when looking at market expansion decisions. Among the reports generated were forecasts of budgets and expenses, which many large and medium firms had difficulty producing reliably.

Managers in this group rarely interacted directly with the computer themselves, largely because their time was demanded elsewhere, away from headquarters and the computer, either in meeting customers, regulators, or suppliers. Since decision-making tended to be largely intuitive, they did not necessarily see the need to use

Table 6.4. Computer Availability and General Function in Small Motor Carriers From a Convenience Sample, June, 1983-February, 1984.

Computer Function and Type	Number of Carriers
had no computer	4
had microcomputers and small mainframes for routine use	3
had microcomputers and small mainframes for routine and analytical uses	1

the computer personally, especially since it appeared to offer them little in the way of supporting a strategic decision.

Discerning the outline of the strategic information system was difficult in the absence of a formal strategic process. If the steps occurred at all, they did so in the minds of the strategists, well hidden from the eyes of the world and of the researcher. Little evidence suggested that computers were integrated into the strategic information systems of this group as a whole, with one exception. Neither the nature of the computer systems, when they existed, nor the attitudes of the managers of the firms, suggested any strategic uses for the computer.

Medium Firms' Computer Integration

Table 6.5 shows the computer systems of the medium firms according to their usage and the manner in which they relate to management. Seven of the eight firms used a combination of mainframes and microcomputers, with the microcomputers frequently dedicated to analysis for longer-term decision-making. In three of these firms, interactive mainframe systems permitted on-line, instantaneous assessment of the profitability of traffic by customer, lane, and other user-selected criteria.

While many of the managers in this group spent time in computer analysis--actually using the machine themselves--it was not a coincidence. Top managers, owners, and directors actively encouraged computer use, clearly considering the data processing an integral part of the firms' management process and of its overall strategy.

Table 6.5. Computer Availability and General Usage in Eight Medium Motor Carriers From a Convenience Sample, June, 1982-February, 1984.

Computer Function and Type	Number of Carriers
had microcomputers and mainframes in networks for analysis and routine use	3
had stand-alone mainframes and mainframes for analysis and routine uses	4
had mainframe used primarily for communications and routine use	1

Those managers who did not adapt were discouraged, generally leaving the firm because they no longer belonged. In effect, the computer had become so important to the management of these firms that managers learned to use them, not just live with them, or they were unable to function effectively.

Most often, the managers who were engaged in strategic analysis used microcomputers. Each firm in this group reported having at least two personal computers dedicated to forecasting and analysis tasks. Mainframes were used to carry out operational functions, such as recordkeeping, communications, and accounting. From the standpoint of computing power, these firms had the capacity to use the most sophisticated techniques. Some were, in fact, using them.

If limitations existed on the degree to which managers in these firms used computers in their strategic information systems, then they were the result of managerial unwillingness, lack of skills with the system, or the restrictive assumptions inherent in computer analysis. Certainly, the machines were available and capable. From the interviews, all but a few CEO's and managers spent time--in amounts which varied greatly according to decision-making pressures and preferences--either using the computer in analysis for strategic decisions, or closely supervising such analysis.

Large Firms' Computer Integration

For the large firms, three major points may be made with respect to the answer to this question. First, as Table 6.6 shows, all six firms had a combination of mainframes and microcomputers which they

Table 6.6. Computer Availability and General Usage in Six Large Motor Carriers From a Convenience Sample, June, 1983-February, 1984.

Computer Function and Type	Number of Carriers
had microcomputers and mainframes for both routine and analytical use	5
had microcomputers for analysis and a mainframe for routine use	1

used for both operational and strategic analysis. The size of the firms seemed to preclude much actual use of computers by the strategists themselves. Ironically, their time, like that of the CEO's in small firms, was demanded for meetings, and for interaction with managers, customers, attorneys, academicians, and regulators, so much so that the use of the computer was secondary.

Second, five of the six firms in this group were actively developing computer systems as part of their marketing strategy. Attempting to create a competitive advantage, these firms were providing linkage software, the means whereby customers may place requests for service on-line, along with a rating system based on the particular carrier's pricing structure. The idea was to create a barrier to switching carriers, while providing essential services at a profit.

Finally, so much of the analysis of the strategic decision-making depended upon qualitative information, and upon the ability of the strategist to conceptualize the business and its position in the market, that the output from the computer could be meaningful only in a created context. Five of the six CEO's, all of the marketing vice presidents, and five finance managers made comments which suggested that they viewed their roles as conceptual, not quantitative, and that they looked at computer-generated analysis as only a part, perhaps a small part, of developing their strategies.

To summarize these three points, it appeared that the computer was more of a strategic weapon than an informant, that managers in large firms do not interact directly with the computer very frequently,

and that the computer was used as a guide, but hardly as a crutch, in the development of strategy.

Summary

It appeared that the medium firms made the greatest amount of use of the computer in developing their strategies, at least as far as the direct contact between the strategist and the computer was concerned. Both the medium and large firms in the study made some use of computer outputs, while the small firms made little use of the machines outside of operations.

In attempting to assess the degree of computer integration into the strategic information system, it was difficult to find quantitative assessments for strategy in the absence of a formal strategic process, a circumstance which characterized all but one of the small firms, three of the medium firms, and one of the large firms. When a routine report had strategic implications in firms of any size, it was found that the integration of that data into strategy development was dependent upon individual evaluations made by the strategists, especially in an informal setting.

Chapter Summary

To develop an evaluation of the strategists' satisfaction with existing SIS's, an inquiry was made into the kinds of information these strategists would like to have but have difficulty obtaining. Among the desired types of information and data, competitive pricing

and strategy, customer trends, and regulatory issues were mentioned by carriers in all size categories.

Computers were integrated into strategic information systems only to a limited degree, with almost strategic use found within the small firms, some strategic use in medium firms, and slightly less use in the large firms. In the medium and large firms, computers seemed to represent more an instrument of strategic thrust than a component in a strategic information system.

CHAPTER 7

ANALYSIS: PART IV AND SUMMARY

Introduction

In this chapter, the two remaining research questions are answered and the analysis is summarized using overall tables which draw from the answers to all six questions. The first question places computer software into the strategic information context, seeking both its contribution and its relationship to the hardware and the human elements. With the final question, the current practices in strategic information processing and collection are examined. As with the previous chapters, the analyses are performed using three categories of firms according to the size of their AGOR. Qualitative and simple quantitative tables are the primary means for presenting the results of the research.

What Software, Including Analytical Packages and Database Management Systems, Contributes to the SIS, and How Does It Relate to the Other SIS Elements?

Introduction

Useful software was common and its relationship to hardware technical and easily determined. To assess the relationship between software and the managers was not as straightforward, since it depended upon a number of attributes associated with the managers themselves.

In the discussion which follows, the software is used as a basis for classifying the firms in each of the three groups according to Mason's (1976) taxonomy of information systems.

Small Firms' Software

For four of the firms, the answer to this question was simple. Since they had no computers, they also had no software, although two had plans for acquiring microcomputers with payroll accounting capability, spreadsheets, and word processing. Because these were anticipated, but not in the firms at the time of the interviews, they are shown in Table 7.1 as having no systems.

Table 7.1 places the eight firms in the perspective of Mason's (1976) taxonomy of information systems on the basis of available software. Those which were classified as having only data bank systems had no analytical packages and only data storage and retrieval capability. In the remaining firm, the software incorporated the ability to project readily into the future, to incorporate assumptions, and respond to "what if" questions.

Although the routine reports were certainly used by CEO's in all of the firms to make decisions, even strategic decisions, it seemed likely that the availability of easy-to-use, responsive software for forecasting and analysis would cause more of each activity to occur. From the sample, this appeared to be the case. Much of the predictive firm's software was internally generated, all of the top management group comprehended its output, and were satisfied in general with the results. Their output included accounting, load and

Table 7.1. Software Systems of Eight Small Motor Carriers From a Convenience Sample Categorized According to Mason's (1976) Taxonomy of Information Systems.

Mason's Categories	Number of Firms
no system	4
data bank	3
predictive MIS	1
decision-making MIS	0
decision-taking MIS	0

specific content of the program. In that managers received both data and information in keeping with their ability and training, such flexibility seemed to enhance the usefulness of the system. Managers were provided with information which they perceived as valuable and comprehensible.

Specific techniques used on microcomputers in these firms included regression analysis, the American Trucking Association's LTL costing system, linear programming, and curve fitting to monitor business cycles. In one firm, over 200 variables were used to make operational comparisons to other firms in the hope of discovering clues to efficiency improvements. Another firm used internally generated data to monitor economic fluctuations in a manner more timely than waiting for governmental reports.

As Table 7.2 shows, half of this group of firms fell into the predictive MIS category, while the other half was in the decision-making category. According to Mason's (1976) scheme, the decision-making MIS carries out the valuation function. It makes comparative value judgments, although it does not execute the decisions indicated by this process. To distinguish between the two groups of carriers, it was necessary to look primarily at the capabilities of the software on their mainframe systems.

In three of the firms, interactive, on-line costing systems provided "what-if" programs to users, a group which included most of the top managers in each firm. Although the internal workings of the systems had been disguised by the consultant who designed all three packages, commitment to these programs was strong among the

Table 7.2. Software Systems of Eight Medium Motor Carriers From a Convenience Sample Categorized According to Mason's (1976) Taxonomy of Information Systems.

Mason's Categories	Number of Firms
no system	0
data bank	0
predictive MIS	4
decision-making MIS	4
decision-taking MIS	0

terminal analysis, and profitability analysis on a number of criteria. While many of these systems were new--less than two years old--they were sufficient to cause this firm to resemble those in the medium group more than those in its own.

For most managers in small motor carriers, software was to be used for routine accounting and record keeping. The tendency was to use the computer to do more efficiently tasks which were already being done manually, rather than to plan for the technology to perform new kinds of work. In an analogous situation, a farmer in the 1930's acquired a tractor. With a mule he had become accustomed to plowing a certain number of rows, and then going back to the house for lunch. On the first day out with the new tractor, he plowed the usual number of rows, and then, even though it had only been two hours, broke for lunch. Not only in small carriers, but also in other firms, the same approach is taken with computer technology. When that is all that the computer is allowed to do, its value is limited.

Medium Firms' Software

In this group, software that was important to strategic analysis fell into two categories: (a) microcomputer packages, and (b) custom software for mainframe computers.

All eight firms used microcomputers with spreadsheets for some form of analysis, generally forecasting. Because this software is so flexible, the level of sophistication of the analysis was dependent more upon the manager's level of expertise than on the

managers. Along with the firm which used multiple variables for firm-to-firm comparisons, these made up the group classified as having a decision-making MIS.

In the other four carriers, the ATA costing system was being used, but not interactively. Allowing for several levels of externally generated data, this package permits the use of either industry averages or firm-generated coefficients in its programs. As the firm develops greater internal data production capabilities, the package come closer and closer to the firm's own costs. Since it lacks the ready "what if" capacity of the programs in the other groups, and since these managers spent much less time in computer analysis, these firms were placed in the predictive category of MIS.

As the analysis of this group developed, the importance of speed and ease of use became apparent in differentiating software systems. Probably all eight firms could perform exactly the same kinds of analysis, but one group, the predictive, could do so only with difficulty. From the tendencies in the industry's relationships with shippers, the time consumed in decision-making may have implications for service levels which mean losing or gaining customers.

Large Firms' Software

From the standpoint of Mason's (1976) taxonomy, the large firms differed little from the medium. As shown in Table 7.3, four firms had decision-making systems and two had predictive systems. Once again, the crucial factor in making the distinction between sub-grouping of the firms was not capability, but the ease with which the

Table 7.3. Software Systems of Six Large Motor Carriers From a Convenience Sample Categorized According to Mason's (1976) Taxonomy of Information Systems.

Mason's Categories	Number of Firms
no system	0
data bank	0
predictive MIS	2
decision-making MIS	4
decision-taking MIS	0

procedures could be used. Firms with predictive MIS's had systems which were more cumbersome to operate, brought results in traditional report forms, in both cases through MIS departments, rather than interacting directly with the decision-makers.

As a rule, strategists in these firms were remote from the analysis packages both on mainframes and microcomputers. Middle managers carried out analytical tasks, though clearly some of them, such as members of the planning staff, worked at strategic functions. To some extent, the remoteness from the analysis was due to the nature of the software still being employed by these carriers.

Table 7.4 shows the analysis packages and techniques used in the process of developing these firms' strategies. In the case of the firm-wide simulations, they were sure evidence of the length of time that the firm had been employing sophisticated computer analysis. Somewhat cumbersome to use, these programs required up to 12 hours of mainframe computer time. In addition, interpretation of their output can be both time consuming and of questionable value. So they have fallen out of use in favor of easier-to-operate, more issue-directed techniques in most of these firms.

One surprising result displayed in this table was that only two of the six firms in this group had data base management systems. Given the enormous quantity of data used by motor carriers, it seems that such a system would be essential, but the disruption of information flow and other operations entailed by the installation of a major system inhibited their acquisition in at least three of these firms.

Table 7.4. The SIS Functions in Eight Small Motor Carriers and the SIS Elements by Which They Are Carried Out, June, 1983-February, 1984.

Human Elements	Analytical Elements	Technological Elements
CEO	published reports	microcomputers
scanning	scanning	none
filtering		
analysis	computer analysis	mainframes
synthesis	tools	none
operational		
managers		
scanning		
filtering		
analysis		
drivers and		
other employees		
scanning		
filtering		
regulators		
filtering		
other firms'		
managers		
analysis		

The use of SAS and SPSS by only three of the six firms tended to suggest that the other three did not use regression, analysis of variance, and other statistical methods which these packages facilitate. But in those firms, engineering departments developed forecasts using custom programs rather than packages. Where in small and medium firms, major distinctions in the computer analysis capabilities could be found, in this group ease and speed were the only distinguishing features.

As is indicated in the table, two firms had all of the software types shown.

Summary

In order to answer this question, Mason's (1976) categories of information systems were used to classify carrier's software systems. First, small firms were found to have either no system, or strictly data bank systems, with the exception of one firm. Little computerized analysis took place in this group of firms. Second, medium firms had either predictive or decision-making systems. The critical difference between the two systems appeared to be not so much analytical capability, as responsiveness. Third, the large firms were found to fit into the same categories as medium, with a slightly larger proportion in the decision-making category. Within this group, a history of analysis on computers was apparent, since some of the software reflected early efforts at developing useful techniques.

How Is the Firm Currently Collecting and Processing Strategic Information for Decision-Making?

Introduction

To approach the answer to this question, three factors from the data were considered. First, the category of the firms according to size. This was consistent with the analysis in the other five questions. Second, the human, analytical, and technological SIS elements and their fundamental relationships were examined. Between size categories, differences were found in the manner in which these elements interrelated. Third, the SIS functions of scanning, filtering, analyzing, and synthesizing were shown under the principle elements which carried them out in that size category of firm. Tables are used to show these relationships. The observed managerial attributes are described, and the physical relationship between the software and the hardware shown in a table.

Small Firm Processing

The CEO and other managers were the primary human elements in the strategic information systems of the small firms. As the discussion which follows suggests, this also made them the principal elements in the strategic information systems of small carriers. Neither the analytical nor the technological elements played a significant role for this group. In a sense, this result was foreordained by the absence of any kind of computer at all in half of the eight firms.

Human Elements

As Table 7.4 shows, human elements dominated the SIS's of the small motor carriers in this study. That the CEO was the central figure in the SIS was also apparent, as is demonstrated in assigning to him duties related to all four SIS functions. Perhaps the enormous information role in which these CEO's were placed detracted from the time and skill which they could bring to actually deciding issues which were crucial to the firm, but this effect was balanced by the intimate knowledge of the carrier's operations which the role carried with it.

Other people within the organization also performed the scanning and filtering functions. Certainly managers and sales people have many opportunities to observe important events and occasions to encounter facts about the motor carrier's operating environment, as do drivers, who may note new competitors, shipment types, or hear customer complaints and comments regarding services or attitudes. In small firms such intelligence can be invaluable, if it is harvested by the strategist. To a limited degree, operational managers in small firms also conducted some analysis. Like outputs from an MIS, most of these analyses had an operational purpose and acted as inputs to the SIS--as data, rather than information. For most firms, they consisted of routine accounting and traffic reports, especially exception reports.

The lack of computer usage appeared to be largely due to lack of experience with and training on data processing equipment, the continued reliance upon less friendly programming languages, and a

preference on the part of these managers for intuition, personal experience, and interaction with other people.

Analytical Elements

Using published articles and reports of analyses of industry and economic conditions was common to managers in all size categories of motor carriers, but for the small firms, general business and industry specific magazines and journals usually represented the only sources of data-based analysis. Since these publications generally printed articles of broad interest, the function that they served was scanning, the broadest function.

Although software used in three of these firms served strictly routine purposes, they might be held to aid some scanning activity since they do identify exceptions through certain reports. The degree to which they carry this out is limited by their nature.

Technological Elements

At the time of this research, the hardware and operating systems served as a storage location for a large data base which received little strategic use. In effect, except for one firm, whose exceptional character has already been discussed, the computer served as an electronic filing cabinet.

Scanning and Filtering, Analyzing and Synthesizing

In the process of interviewing the strategists and managers in these eight firms, the degree to which their success or failure depended on a small number--usually one or two--individuals was

apparent. This dependence also arose in looking at the SIS functions of scanning and filtering. Within the scope of their jobs, they had to determine what areas were crucial to the success of the firm, identify useful data of both qualitative and quantitative nature, eliminate the useless, examine it for worthwhile relationships, and associate it with important decisions. That they might be able to do more in each function was undeniable, for there were many techniques available, and sources and technologies which they did not use, but their success in managing their firms was also apparently great, despite these lacks.

Medium Firm Processing

Much greater balance in the use of the three elements for SIS functions was apparent in the medium firms. As Table 7.5 shows, computers and communications systems made some contribution to the strategic information systems in a direct way, where in the small firms this occurred only through the filter of the CEO's experience. The utility of each of these elements is discussed in the sections which follow.

Human Elements

As with the small firms, the focus of the strategic information flow among the human elements was the CEO. Since he was the principal strategist in all of these firms, this had an inherent logic that could not be denied. Unlike his counterpart in the small firms, he was not the exclusive center of the SIS. Some of the analytical and

Table 7.5. The SIS Functions in Eight Medium Motor Carriers and the SIS Elements By Which They Are Carried Out, June, 1983-February, 1984.

Human Elements	Analytical Elements	Technological Elements
CEO scanning analysis synthesis	integrated software filtering analysis	mainframe computer scanning filtering analysis
functional managers scanning filtering analysis	packaged software filtering analysis	microcomputer scanning filtering
other employees scanning filtering	custom software analysis filtering	communications systems scanning
regulators filtering	published analysis scanning	
other firms' managers scanning filtering		

synthesizing duties fell to functional managers within these firms. Hence, some of the information that came from other people went to the marketing vice-president, for example, rather than the CEO.

Because they are recipients of internal information as well as external, these managers play a key role in the SIS. They were like the CEO's, both informants and decision-makers, though their strategic tasks were weighted more in the direction of informing than deciding--at least from the strategic standpoint.

Drivers and lower level employees had less contact with the CEO's in these firms than in small firms. As a consequence, the intermediary role of the supervisory managers and functional manager increased. Sales force information remained vital, with some level of direct contact between strategists and employees, a kind of contact which was lost in the large firms.

From outside the firm, regulators and managers of other companies were sources of analysis, and to a limited degree, scanning assistance. The CEO's of the medium firms sought out specific individuals with knowledge about regulatory and industry trends. When specific questions arise, or when uncertainty about some area in the company's environment appeared, the CEO would meet with selected, well-versed individuals whose comments would assist them in their decision-making. In effect, they developed and encouraged a network of strategic informants.

Without question, the human aspects of the SIS retained an enormous importance as the size of the firm went from small to medium, but somewhat less of each function was assigned to the CEO, leaving

more of his time and energy available for decision-making and the remaining SIS functions, especially synthesis. No doubt, too, the human elements in these firms received greater assistance from analytical and technological elements in the SIS.

Analytical Elements

In studying the four categories of analytical elements used by the medium firms, the importance of the fundamental nature of each became apparent. For example, the integrated software, which for three of these firms performed on-line contribution ratio analysis, scanned in the sense that it only carried out certain kinds of quantitative analysis on historical data. Even though the operator could change the parameters in the packages, the nature of the mathematical operations remained the same. Thus, the contribution ratio provided by a particular shipper could be analyzed, but qualitative data regarding loyalty or potential had to come from other sources. The nature of the program limited what managers actually received as information, thus also filtering the data.

In fact, the same statements may be made about all of the software packages. On one hand, for those packages and programs developed within the firm, certain assumptions were made which excluded one kind of information in favor of another. On the other hand, in purchasing programs from outside vendors, the firm also purchased a set of exclusionary assumptions, along with analytical power, assumptions over which the firms had even less control. Perhaps the broadest assumption in either case was that only quantitative data would be

used in creating analyses for profitability-related decisions. It was left to the human elements to provide qualitative data and to carry out the SIS functions in their regard.

Technological Elements

In many ways, the technological elements made no contribution to the SIS that was independent of the software used on them. Acting more as an element in the strategy than a source of information for its development, these mainframes were used to assist in providing better customer service by aiding quick responses to pricing requests, providing a data base for networked microcomputers, and linking work stations through communications packages. Since they were employed largely in this manner, their use in strategic analysis might be questioned. Nonetheless, they were the operating capacity, the pathways over which analyses travelled, and they were a limiting factor in the type of intelligence provided and the frequency with which it became available. Thus, technology had a role in the SIS in scanning, filtering, and analysis. Its strategic information capabilities were well-exploited in the medium firms.

In turning to the microcomputers, the strategists in the medium firm generally had an analytical purpose. With the basic spreadsheets, the flexibility of the system tended to encourage more analysis on these machines, rather than on the more restrictive mainframes. Comparing the usage of the microcomputer to the mainframe, the scanning and filtering diminished, while analysis increased. When not networked, the data bases in the machines were limited,

which reduced the need to scan or filter, simply because those functions had to be performed to a great extent in the process of assembling the data base.

Large Firm Processing

In this group, which included some of the largest motor carriers in the United States, it was anticipated that the most sophisticated and current computer technology would be coupled with advanced software to give strategists access to vast data bases and user-friendly analytical tools. Not all of the firms met this expectation, and, as a group the managers at the strategy making levels were seldom in direct contact with the computer. As the following sections suggest, the strategic information systems in these firms were highly dependent upon the human element.

Human Elements

As Table 7.6 shows, the balance of the strategic information functional responsibility has shifted within the human element in large firms when compared to medium. Even though enormous amounts of data and information flowed his way in these firms, the CEO had primary responsibility as a synthesist of strategic information, rather than analyst, scanner, or filter. To a large extent, this was true of the functional vice-presidents as well, although they retained more of the analytical function than the CEO.

Assisting the strategic decision makers, a core of strategic analysts assumed much of the scanning, filtering, and analyzing.

Table 7.6. The SIS Functions in Six Large Motor Carriers and the SIS Elements by Which They Are Carried Out, June, 1983-February, 1984.

Human Elements	Analytical Elements	Technological Elements
CEO synthesis	custom software scanning filtering analysis	mainframe computer scanning filtering analysis
functional vice-presidents		
staff planners synthesis scanning filtering analysis	packaged software SPSS,SAS analysis	microcomputer analysis
consultants scanning filtering analysis	data services (Dow Jones, Chase Econometrics, etc.) filtering	communications systems scanning
other firms' managers scanning	microcomputer, integrated system software analysis	
regulators scanning analysis		
lobbyists-group and for the firm analysis scanning		

Composed largely of staff planners and functional area middle managers, the groups were the primary users of computer technology, and sources of qualitative strategic data also. As their analyses moved upward through the management chain, it became more and more aggregated, so that the synthesis of the information was also taking place as it moved through organizational channels. Thus, the planning staff is shown in Table 7.6 as serving analysis, filtering, scanning, and synthesis functions.

Less comes from other large firms' managers into these firms, due to the direct nature of competition between them. While a small motor carrier's CEO in Montana may be willing to share ideas with a counterpart in Louisiana, the same is considerably less likely to happen between CEO's in large firms, for both legal and competitive reasons.

Legislators, regulators, and lobbyists all played some role in either analysis or scanning. In some cases, they warn of impending events or analyze potential results. Except in instances where the firm employs its own lobbyist in Washington, D. C., their input was general, and required interpretation to fit the circumstances of a particular firm.

Because they have so many internal resources, few of these firms hired general management consultants. Rather, they hired marketing research or labor relations specialists to assist in the solution of specific problems. As a rule, the large carriers relied more on internal management talent for strategic information functions.

Analytical Elements

Where medium firms operated with integrated system software on their mainframe computers, large firms had such systems only on microcomputers in mini-networks shared by staff planners and engineering sections. Because of their location in the organization and the nature of the software--statistical packages and spreadsheets--the function served was largely that of analysis.

On one hand, the custom and system software on the mainframe computers were well integrated into the large firms operations and into their planning systems, largely because of the size of the organizations. On the other hand, because of the age of some of these systems and the nature of the techniques incorporated into them, they appeared monolithic, cumbersome, and unresponsive to strategy-related requests when compared to the integrated software on mainframes in some of the medium firms. Part of this was due to the size of the organization and the distance between the strategic decision-maker and the analytical elements. Under the constraints brought about by size, there was little likelihood of direct use of the computer's mainframe system by CEO's. Also, the age of the mainframes was relatively great, so that the software was not necessarily state of the art.

A manifestation of this age problem was the continued existence of firm-wide simulations, which used so much mainframe computer time for such questionable purposes. They did not appear to fare well in a cost-benefit analysis. Such programs reflected the fact that these firms had been making serious analytical efforts with the computer

over a long period of time. At the same time, they suggested that at least some of the firms were due for a major revision of analysis policies and programs.

In all of the large firms, an important feature was their subscription to and use of data services, such as Dow-Jones, Inc., Chase Econometrics, and Data Research Incorporated. Analyzing these data bases and also using analysis which these organizations already provided gave many of the managers involved in the strategic information process the opportunity to compare forecasts and develop a consensus about key economic conditions in the future.

Technological Elements

To separate the computer from the software routines was sometimes difficult in this analysis. But a shift in utilization of computing capacity was visible as a result of this research. First, mainframes were being used for planning and analytical purposes to a lesser degree than in the past. Since the primary thrust of the large computer in this group was to manage the tremendous volume of data generated by operations, planning related projects often had to wait for computer time. By shifting these activities to microcomputers, the strategy-makers got information more readily and the pressure on the mainframe was reduced. This latter point was of particular importance, because all of the MIS managers reported backlogs of new applications requests which could be measured in person-years.

Second, the mainframe was playing a role in communications system development. As such, it did not provide that much strategic

information, but it was a major element in the strategic thrust of many large firms. It became an instrument for improved customer service through order tracing, quick response to pricing requests, and ties for computer-to-computer shipment requests.

Filling the analytical role, then, were the microcomputers. Because they were also incorporated into communications networks and could access mainframe data bases, they had the ability to produce responsive, detailed analysis which related to strategic issues. They also were used to filter and to define scanning areas for further study. Consequently, while mainframes were still being used for three SIS functions, they usage was gradually being moved to the smaller machines.

Summary

In answering this question, the issue of the integration of the entire strategic information system was addressed to some degree. The elements which cause the system to adhere were human, analytical, and technological. In small firms, the human element was dominant, while the other two categories of firms had greater balance overall, making more use of the other two elements of the system. To a certain extent, the nature of the elements relied upon dictated the degree to which the functions were carried out.

Summary of the Analysis

To summarize the analysis portion of this research, Table 7.7 draws from the discussion of all six research questions, as well as

Table 7.7. Summary Table from Analysis of Groups of Small, Medium, and Large Motor Carriers and Their Strategic Information Systems, June, 1983-February, 1984

Sample Description	Sources	Important Decisions	Scanning Areas	Variables	Information Needs	SIS Functions and Elements
Size \$1.2 million- \$1 billion in 1982 AGOR	<u>Small Firms</u> customers drivers sales force regulators legislators managers competitors	<u>Small Firms</u> stay in business expand markets specify prices finance purchases personnel selection interlining	<u>Small Firms</u> economy competitive pricing competitive services state and federal regulations	<u>Small Firms</u> traffic level GNP profit & loss unionization in new markets interest rates customer statements prices in market complaints successes by competitors utilization of equipment	<u>Small Firms</u> internal costs competitors' prices timeliness overloaded	<u>Small Firms</u> human elements scanning filtering analysis synthesis analytical elements scanning technological elements none
8 small (\$1.2-20 m.)					<u>Medium Firms</u> costs other than LTL	
8 medium (\$21-100 m.)	<u>Medium Firms</u> customers competitors competitors MIS drivers bankers regulators legislators potential customers outside experts	<u>Medium Firms</u> stay in business expand markets structure prices use of debt personnel relations diversification	<u>Medium Firms</u> competitive pricing competitive services financial markets			<u>Medium Firms</u> human elements scanning filtering analysis synthesis analytical elements all but synthesis technological elements all but synthesis
6 large (\$100 m. up)				<u>Medium and Large Firms</u> revenues by segment profits by segment traffic patterns price elasticities personnel attitudes customer cycles competitors' successes relative performance equipment use union activity interest rates labor regulations response to contact employees survey data backhaul levels management skills market share outsiders' expertise regulatory rulings	<u>Large Firms</u> competitive prices customer information overloaded	
Software systems in Mason's (1976) categories						
<u>Small Firms</u> data bank predictive no system	<u>Large Firms</u> data services customers investment bankers outside experts MIS	<u>Large Firms</u> segmentation selection of top managers identify strategic informants	<u>Large Firms</u> economy competitors' pricing organizational response to strategy industry innovations		<u>Computer Usage</u>	<u>Large Firms</u> human elements all analytical elements all but synthesis technological elements all but synthesis
<u>Medium Firms</u> predictive decision- making						
<u>Large Firms</u> predictive decision- making	regulators legislators competitors traffic research				<u>Small Firms</u> no computer microcomputers small mainframe	
					<u>Medium and Large Firms</u> microcomputers and mainframes in networks stand-alone mainframes communications networks	

providing a basic description of the sample. The data are presented by size category--small, medium, and large. In some cases, the headings are combined because the factors for two groups overlap (for example, scanning factors for medium and large firms).

Scanning Areas

Once again, commonalities were apparent between the three groups. Government, customers, competitors, and resources were the categories of interest to all of the firms. Strategists in the small firms did not mention customers as an area to scan, although they were mentioned as a source of data, and their statements were considered variables for scanning. This was probably because customers were seen as individuals, rather than as an aggregate. Large firms examined the customer decision-making processes, while medium firms were watching large carriers' activities. Causing the organization to respond to strategic decisions was also a major interest for strategists in the large firms.

Variables

As with the sources, moving from the small through the medium and large carrier uncovered a longer and longer list of factors incorporated into the scanning process. Categories of these variables coincided with those used to describe the scanning areas. As the decisions were brought into the matrix, the relationship between the areas, the decisions, and the scanning variables was shown. Table 7.7

shows the variables and identifies the size category or categories of firms which identified them as useful.

Information Needs

The most general perceived need for more information was found among the CEO's of the small carriers. While the list of needs was longer for the medium firms, each item named was more specific. Strategists in the large firms saw little need for more information in general, but a great need for better information about competitors' pricing and about customers, especially their decision-making processes and useful criteria for developing market segments.

Computer Usage

Lacking computers, this question was of no concern to four firms in the study. For the others, as a general rule, the strategic uses of information technology changed as the size of the firm went from small to medium. No such leap in technology was visible in the transition from the medium to the large firms, where the usage of both microputers and mainframes was similar. This data is reflected in the computer use column in Table 7.7.

Software Systems

When the software was used as a basis for classifying the firms' information systems in Mason's (1976) categories, small firms were found to have no system, data bank, or predictive systems. Both the medium and the large groups, as shown in Table 7.7, had predictive

and decision-making systems. The distinction between the predictive and the decision-making systems appeared to be largely due to the timeliness of responses, rather than the fundamental capabilities of the software.

Strategic Information Systems Elements and Functions

Regardless of the firm's size, the most important elements in the strategic information system were the human elements. In all three groups, the human elements carried out all four functions--scanning, filtering, analyzing, and synthesizing. Medium and large firms drew from both analytical and technological elements, in addition to the human element. This produced a greater balance in the systems in these carriers, as is shown in the last column in Table 7.7. Perhaps this balance is the crucial element in creating the best possible strategic information system for a particular firm.

Chapter Summary

In this chapter, the last two research questions were answered and an overall summary of the analysis was presented. The software used by firms in each group were used as the basis for classification into Mason's (1976) categories. Small firms had data bank or predictive systems, while medium and large firms were found to have either predictive or decision-making systems. In terms of the overall processing of strategic information, all of the firms tended to be dominated by the human element, although medium and large firms

appeared to be more balanced than the small carriers. Finally, a summary table, Table 7.7, was presented and discussed. Data gathered in response to each of the six research questions were shown in the table, and the analysis of the data was described briefly.

CHAPTER 8

SUMMARY, CONCLUSIONS, AND FUTURE RESEARCH

Summary

As the motor carrier industry enters a competitive and uncertain era, this research has examined the manner in which its managers gather, process, and use information to make strategy. Drawing from two bodies of literature--information systems and strategic management--which overlap on the subject of strategic information systems, the purpose of this research was to explore SIS in the industry and to develop a prescriptive model to assist motor carrier managers in the enhancement and creation of such systems.

A series of research questions was devised to carry out these intentions, and to determine the sources, processes, and flows of data and information for motor carrier strategy. Based on interviews with 62 managers in 22 firms, a variety of answers to each of the questions was uncovered, along with some commonalities which bridged even the fundamental difference of organizational size. The study included carriers with 1982 AGOR's from \$1.2 million to \$1 billion, with eight firms defined as small (less than \$20 million), eight medium (less than \$100 million), and six large (greater than \$100 million).

The areas to be scanned were the subject of the first question. Responses were clustered into categories of customer, competitor, and government behavior, along with the resources of the firm. Defining the business, staying in business or not, expanding markets and operations, and pricing were among the key decisions identified as affected by information from these sectors of the carriers' environment.

Scanning these areas required variables--or subareas for scanning--which were available, easily understood, and timely in order to assist top management decision making. For customers, traffic flows, sales revenues, and measured or stated attitudes supplied the basic data from which information was ultimately derived. Prices, service offerings, and markets covered were identified as subareas under competitive behavior. They corresponded to specific variables of price and discount structure, service features, and new activity in markets. Perhaps the closest tie between the area scanned and the variable was in government behavior, where principal sources--legislators and regulators--were also principal actors. Since these may control the industry in concert, it was the collective attitude that was of concern.

The degree to which strategists in the sampled firms were satisfied with the strategic information available to them, which was the subject of the third question, varied, but most of the variation could be explained by size. Small firms lacked costing, competitive pricing and strategy, and government information. The managers in these firms felt close to their customers, however. Adding some

need for knowledge of trends in key shippers' industries, medium firms indicated highly specific information needs which generally fell into the same categories as those of the small firms. Large firms' managers, by contrast, seemed satisfied with internal, competitive, and government information, even citing overload as a common problem. They missed, if anything, data on the attitudes, preferences, and decision making of customers, especially the economic--versus technical--purchasers of transportation and motor freight services.

Another question--the fourth--on which answers differed radically by firm size concerned the integration of computer systems into the strategic information process. Small firms, with one exception, had no hardware that was in any way distinct from the firms' MIS's. Half, in fact, had no computers at all. For medium firms, the computer system was often integrated with almost all decisions, leaving the problem of determining the point at which they became strategic. Strategists in the medium firms were frequent users of computer systems, so that, in a sense, the system had to be integrated. Executives in large firms, on the other hand, used computer outputs on occasion, but more often received results and interpretations from subordinates and reports. In a sense, their activities, which emphasized face-to-face synthesis of information, resembled those of the CEO's in small firms, who also stressed interpersonal techniques for gaining information. The technical aspects of information generation, of course, differed radically between the two groups.

No question revealed more technical distinctions between sizes of carriers than the use of software, which was the focus of the fifth question. Small firms had little beyond payroll accounting programs, with the exception of one firm. Medium firms had interactive systems with "what if" capabilities, along with microcomputers and spreadsheets. Powerful analytical packages, such as SAS and SPSS, tailored programs, and microcomputer statistical packages were all found in the large firms. Data base management systems were found in only three of the firms in the entire sample.

The final question considered how the firms were currently processing strategic information. The answer which revolved around scanning and filtering, analysis and synthesis, depended upon the performance of the functions of the strategic information system by the human, analytical, and technological elements of the system. These principal processes could be found to some degree in every firm in the study. However, like the strategic processes to which they are so closely related, as the firms grew larger, the system became more visible and more likely to be formalized. Even in the largest firms, judgments about quality were difficult to make, but the presence of organizational commitment to some data and information procedures became formalized and tangible. Scanning seemed to take place two organizational levels below the decision-maker, while filtering occurred one level below. Analysis was one or two levels below, or both. Separating synthesis of information from the strategic steps of analysis and formulation (Hodgetts and Wortman, 1980) caused some difficulty, since this part of the function appeared

to be partly the CEO's role. Differentiating between the sizes of firms, the large and medium firms used a balance between the three elements, while the small and medium firms relied heavily on the human element.

Conclusions

Based upon the analysis of the data collected in this research, two models were developed to carry out its intent. First, a set of guidelines was produced for the creation of strategic data bases and identifying the factors which should be included. Second, a conceptual model, first shown as Figure 2.1, page 41, was modified to reflect these findings.

Strategic Decision Profiles

Designing and organizing a strategic information system for the motor carrier industry depends largely upon the identification of the information needed to make particular decisions concerning the overall welfare of the firm, and then making certain that it is available when needed. From the analysis of the scanning areas for the motor carrier industry, this information should be drawn from four areas of the environment--customer, competitor, and government behavior, and the resources of the firm. Therefore, the strategic information system should capture the key factors in each of these categories, and it should relate that profile to specific decisions.

In Figure 8.1, four strategic decision profiles are shown. Each suggests the means for describing important circumstances about a particular area of the environment.

Customer Profile

In this profile, four major categories of information are shown. First, the nature of the traffic should be described, which will have implications for pricing and profitability issues. Second, the behavior of the customer with respect to price, service variables, modes, and carriers, suggests potential for the carrier and may also help to identify areas of potential weaknesses. Third, beyond their basic behavior patterns, some customers are more important to the firm than others. The factors shown in this category lend themselves to the creation of a multi-level approach to the market, with the most significant customers attended by a national accounts sales force, a second tier by a terminal-level sales force, and a third level served through telemarketing. In effect, this category of variables may be used for the ABC analysis of customers. Finally, the demographics of the customer may suggest future market approaches and strengths and weaknesses in the firm's programs.

Competitor Profile

The competitor profile offers clues to the presence and relative strengths of competitors in a carrier's markets. As a foundation for analyzing relative market strengths, the markets which are common to the firm and the competitor must be identified, the competitor

<u>Competitor Profile for Strategic Decisions</u> <u>Common Markets</u> Size of Marketing Effort: Segments Served: Market Share Within Segments: No. of Terminals in Each Geographic Segment:	<u>Market/</u> <u>Customer Profile for Strategic Decisions</u> <u>Potential in the Long Run:</u> <u>Nature of Traffic</u> Density: Volume: Value: Rate as a % of Value: Direction: Fit with Current Operations:	<u>Regulatory Profile</u> <u>Labor Regulations</u> Union Strengthening Effects by State: Restrictions on Hiring: Level of Enforcement:	<u>Economic Regulations--State and Federal</u> Service Area Restrictions: Pricing Restrictions: Deregulatory Trends: Level of Enforcement: Restrictions on Corporate Relationships:
<u>Demographics</u> <u>Financial Condition:</u> Size: Location of Headquarters: Unionization: Corporate Relationships:	<u>Behavior of the Customer</u> <u>Customer's Modal Mix:</u> Customer's Motor Carrier Mix: Sensitivity to Price: Loss and Damage: Claims Service: On-Time %: Reliability: Speed: Convenience: Extraordinary Services: Identity or Position of Economic Decision Makers: Identity or Position of Technical Decision Makers:	<u>Safety Regulations</u> Licensing: Fitness to Serve: Mileage, Hours: Weight:	<u>Financial Resources</u> Availability of Funds Effective Interest Rate Investment Needs Cash Available Return on Investments Leverage-Financial Growth Potential Asset Turnover Operating Ratio Effective Tax Rate Stage in Business Cycle Revenue Levels Cost Structure
<u>Apparent Strategies</u> Frequency of Service: Price Structure: Discounting Policies: Reliability: Loss and Damage: Costs: Equipment: Fleet Condition: Use of Owner Operators: Debit Position: Sales Force/Driver/Analyst Comments:	<u>Significance to the Firm</u> Revenues Generated: Costs Incurred: % of Total Business: Claims: Profitability: Trend in Revenues: History of Relationship: Salesforce Evaluation of Prospects:	<u>Resources Profile</u> <u>Physical Resources</u> Fleet- Condition: Utilization: Replacement Schedule: Terminals: Truck Time in Loading: Shipments/Door Volume In/Out Human Resources Managers- Skills: Performance: Conditions of Performance: Functional Area:	<u>Strategic Information</u> Area of Knowledge: Basis for Reputation:
<u>Strengths and Weaknesses</u> Overall Market Share: Service Failures: Service Successes: Customers Lost To: Customers Gained from: Reasons: Utilization: Management Skills: Assessment of Strength in Market:	<u>Demographics</u> Industry: Size: Geographic Extent of Operations: Satisfaction with Existing Carriers:	<u>Drivers and Terminal Employees-</u> Productivity Wage Levels Attitude toward Firm Turnover Union Activity Grievances	
	<u>Trends in Customer Industry:</u> Business Cycle:		

Figure 8.1. Strategic Decision Profiles

demographically described, apparent strategies delineated, and the strengths and weaknesses clarified.

Regulatory Profile

Although economic regulation has diminished in significance for most carriers, this profile is still essential. The three categories shown--labor, economic, and safety--are still of major importance in both interstate and intrastate markets. For many small and medium firms, the tendency for some regulations to strengthen unions in potential market areas is a strategy-altering factor. Therefore the carrier should collect data to monitor these areas carefully.

Resource Profile

The strategic value of the firm is not merely a matter of its balance sheet, but a measure of its flexibility in meeting evolving market needs. This profile suggests variables which measure flexibility and potential effectiveness of financial, physical, and human resources. To achieve greater cost, financial, and human flexibility is critical in the use of this profile.

Using the Guidelines

Although the profiles shown indicate single competitors and customers, they may also be used for analyzing market segments, groups of customers, and groups of competitors. These profiles suggest the types of output which should emanate from the strategic information system, and, hence, have a powerful, perhaps definitional, effect of SIS design, organization, and methods.

The Strategic Information System

Based on the analysis of results, the model originally shown in Figure 2.1, page 41, has been modified to appear as in Figure 8.2. While the major elements remain largely the same--the environment, the strategic information system, and the strategic decision making process--some features have been added and the information flows have been altered. In the sections which follow, each of these features and elements is explained.

The Environment

Data is collected from both internal and external sources into the organizational data base, where they are ready for scanning. This data may be collected and stored in the minds of firms' members (human) or on paper or in computers (technological). In the context of the model, this restructuring is termed data-base development. These data bases are part both operational and strategic decision-making. New computer technology has greatly increased the ability to collect and access information so that the distinction between quantitative and qualitative data is no longer meaningful. Therefore the model shows a single data base for the organization. Typically, the organization will capture needed data that is routinely generated and consistent in form through technology. The infrequent, nonroutine data, such as customer anecdotes, articles about economic prospects, and reports from drivers or salespeople is typically part of the human data bank.

Strategic Information Processes

The four processes of scanning, filtering, analysis, and synthesis remain at the heart of the strategic information system, along with adaptation, which serves to fit them into the decision-making environment. In scanning, the areas and factors of interest are identified. Filtering reduces the data, eliminating unnecessary data, to produce information relevant to decisions. Analysis structures the data for particular decisions. In synthesis, all of the data relevant to a particular decision are assembled and made cohesive. Through the adaptation process, shown in the model as a series of feedback loops, the strategic information processes continually interact with the organizational data base. If new requirements are discovered during the analysis and synthesis of data, to the data bases to collect additional information now deemed important, then the adaptation processes of the system cause it to return.

Strategic Decision Profiles

The strategic decision profiles play a critical, definitional role in the strategic information system. By allowing the decision-makers to describe the specific types of information that they will need for strategic decision-making in general, as well as for particular decisions, they insure that the data needed for synthesis, analysis, filtering, and scanning is available. Thus one of the essential factors for effective strategic decision making is the prior analysis of information needs to feed the strategic decision-making process.

Strategic Informants

An extraordinary role in the model was assigned to this particular category of people because they have the potential for not only providing information on specific decisions, but also on the processes of the strategic information system, the development of data bases, the strategic decision profiles, and the strategic decision-making process itself. Although they may come from both inside and outside the organization, they have in common the ability to influence significantly all parts of the model except the environment. These potential influences are indicated in the model by the arrows emanating from the strategic informants.

The Strategic Decision-Making Process

It is within this process that the output of the strategic information system is used. In a sense, it is also here that the need for the strategic information system arises. A circular relationship exists between the two systems, because it is information which identifies the need to make a decision, but it is the decision which defines the kind of information sought. Based on this research, the strategic decision-making process and the strategic information system are parallel and inseparable.

Implications of the Research

In each of the three categories of firms examined in this research, the results have slightly different implications. There are also some implications for the motor carrier industry as a whole.

In the sections which follow, these implications are examined in detail.

Implications for Small Firms

For small firms, the message of these results is that there is a need to gather more information with strategic content, to add and to upgrade technology, and to educate managers in the use of information systems. Although the computer technology itself is beginning to spread throughout the industry, having a computer is not the same as knowing what to do with it. Simply using the machine to print the payroll checks and keep payroll records is failing to make use of the potential of the technology. Up to a certain size of organization, the manager may keep all records by hand and develop data into information in his or her head. Beyond that size, the automated record-keeping becomes useful, as does the development of other means for converting data into information. Then the manager need not know everything, but rather how to get at what is needed at the time. This is the essence of designing information systems, strategic or otherwise.

A further implication of this research for small firms is that their managers need to think strategically. The notion that strategy is initiated daily and altered from one minute to the next may allow the firm to survive through good times, but, given the nature of the business cycle, may not lead to prosperity in the inevitable bad times which follow. Bringing information to bear on the long-run

position of the firm in its markets is an essential management task, one which small firms too often leave to chance.

Implications for Medium Firms

The medium firms which were included in this study had, in many respects, the best of both worlds. With greater resources than the small firms and greater flexibility than the large firms, they employed the available technology to generate a great deal of information for decision-making. Perhaps the most significant lesson to come from this study for managers and strategists in these firms is that they must always consider the impact of growth on their ability to gather and use information. The large issue which faces these firms is that of defining their role in the industry over the next 20 years. Their systems need refinement and need to incorporate more nonquantitative data, but in terms of getting the information directly to the user, they are in the strongest position in the industry.

Implications for Large Firms

The strategic information systems in this group may rest on a highly sophisticated technological foundation, but there is a real concern that the information is not going to the strategist. While delegation is essential to the operation of a large organization, it will not substitute for the intimate knowledge on the part of the decision-maker. It is often too easy for the strategist in the large firm to become separated or aloof from the data base and receive only information that has been processed by computer professionals or other

managers, who decide to a great extent what will be seen. There is a real need for strategists in large firms to be aware of the data that they want collected, and the manner in which they want it presented when it is needed. One way to implement this for routine data bases is through a decision support system or a small computer which will interface the firm's mainframe.

Implications for the Industry

For the industry, the implications of this research are based upon what the firms within it generally do not know. First, they do not understand their customers very well. Having not marketed for 40 years of federal regulation, managers in the industry do not know how. Much research needs to be done by particular firms, and in general, before the customer can be adequately profiled. Second, because the processing of information in both the technical and organizational sense is going to be crucial to success in the industry, carriers must begin to recognize information requirements in their organizational structures. Strategy-making must begin to occur at lower levels in the large firms, and information must be made available to those strategists. In connection with this, the information-gathering aspects of the strategists' job should be fully acknowledged. Third, a broad view of markets, competitors, and customers should be adopted in strategic decision-making and information gathering. It would be tragic for the industry to fall into the trap of defining their business too narrowly. Finally, commitments to the building of flexible, useful information systems must be made. Implementing the

system inherent in the strategic decision profiles presented in this research is not a simple, one time task, but a continuous process which will take resources. Only the commitment from the top of the organization will make the system effective and generate returns.

Future Research

Since this research was exploratory in the questions asked and in the methods used to answer them, many avenues for additional study have been opened. They fall into three main categories: a) the extension of the present study within the motor carrier industry; b) the application of the methodology to answer the same questions in other industries; and c) the re-examination of the same questions in the motor carrier industry over time. Each of these categories for future research is discussed in the sections which follow.

Extension of the Research in the Motor Carrier Industry

Because only 22 firms were included in this study, its results and conclusions need to be tested in a larger sample of carriers. Either surveys or more interviews in a larger number of carriers could be developed, using a sample stratified on the same size categories. Due to the extent of the six questions studied, more than a single survey may be necessary to test the model developed here. Additional issues raised include the relationship between the SIS and the performance of the firm, criteria for determining the effectiveness of the SIS, and the extent to which firms in other regions of the United States rely upon the human, analytical, and technological elements in

the SIS. The geographical extension of the research is especially important for the small and medium firms, whose markets are restricted in those terms. In the northeast, midwest, or far west, carriers in these size categories may display different characteristics with respect to their strategic information systems.

Extension into Other Industries

There is no reason to assume that other industries will display the same characteristics of strategic information systems as the motor carriers. They do not share the same history--or at least most do not. Even within transportation, the railroads, water carriers, pipelines, and airlines should be studied in the light of these results. Because of the influence of the service-providing technology, the strategic information systems in these industries may be structured differently from those in the motor carriers. Other service industries, manufacturing, and non-profit organizations could also be examined. Useful results may be obtained from a study which develops categorical comparisons within sectors of the economy. For example, using third sector, institutional, and public (Wortman, 1979), the SIS's in non-profit organizations may be analyzed. In the service sector, capacity constrained and financial services (Davis, 1984) may provide appropriate categories for research. Finally, comparisons may be developed between sectors.

Over Time

In an area where technology has had such an enormous impact, repetition of this research within three years might produce significantly different results, even if the same firms were studied. As the price of computing capacity falls and the capability of the software increases, the change in the strategic information systems of motor carriers may be great. The dissemination of technology among a higher percentage of the small firms would be among the first adjustments expected to be made to the present results. In effect, more carriers might be found to approach the model shown in Figure 8.2. As stream of research on strategic information systems would also include the extension of time and repetition of studies on other industries, and of other research projects which stem from this one. Because it bears a fundamental relationship to the nature of the organization which houses its, the strategic information system is not likely to be static, either in its fundamental relationships or in the elements which compose those relationships.

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APPENDICES

APPENDIX A

GUIDELINE QUESTIONS FOR INTERVIEWS

Questions for the CEO

What are the important decisions that you make?

How do you make these decisions?

How do you know when you need to make one of these decisions?

What do you need to know to make these decisions?

Where do you find this information?

How do you use a formal MIS or the computer to help you make these decisions?

What information do you have difficulty obtaining?

What information would you like to have, but can't get?

Questions for the Marketing Manager

What are the important marketing decisions that you make?

How do you make these decisions?

How do you know when you need to make one of these decisions?

What do you need to know to make one of these decisions?

How do you get this information?

How do you use a computer or a formal information system to help make these decisions?

What information do you have difficulty obtaining?

What do you do with the data or information after you've obtained it?

What information do you give the CEO?

What would help you do this part of your job more effectively?

Questions for the Accounting/Finance Manager

What are the important financing decisions that you make?

How do you make these decisions?

What do you need to know to make these decisions?

How do you get this information?

How do you use the computer or a formal MIS to obtain this information?

What information do you have difficulty obtaining?

What do you do with this information after you've obtained it?

What information do you give to the CEO?

What would help you do this part of your job more effectively?

Questions for the MIS Manager

What computer system do you have?

What data base management system do you use?

Is your data base distributed, centralized, or decentralized?

What analytical software do you have available?

What kinds of data or information does your unit give to marketing?

What kinds of information does your unit give to finance or accounting?

What information do you provide to the CEO?

What is the current level of utilization of available capacity in your system?

How long is your queue for new applications for the computer?

Do you consciously employ sources of information or analysis other than the computer?

What changes would you make in your system to improve it?

What would help you do your job more effectively?

APPENDIX B

SUMMARY

The Design, Organization, and Methods of Strategic Information Systems:

A Case Study of the Motor Carrier Industry

Doctoral dissertation research by Stephen A. LeMay

Definition and Functions

A Strategic Information System (SIS) is an organized procedure for locating, collecting, analyzing, storing, and using qualitative and quantitative data to support decisions which are crucial to the long-term survival and prosperity of the firm. Strategists should consider SIS in the light of the following functions: a) the SIS must be able to identify factors within the firm which are important to the cost of providing service; b) the SIS must be able to identify factors in the firm's environment which are important to relationships between the firm and its customers; c) the SIS must be able to show how these two sets of factors interact; d) the SIS must be able to gather data on all of these important factors and interactions; e) the SIS must be able to transform this data into information which is useful to the strategist; and f) the SIS must be able to adapt to both the changing internal and external environments.

Purpose

The purpose of this project is two-fold: a) to explore the SIS design, organization, and methods of the motor carrier industry; and b) to develop a prescriptive model of SIS to aid managers in dealing with strategic issues in the industry. The central assumption of this research is that the ability of the firm's SIS to provide top managers with the information they need to understand their environment and their organization is a primary determinant of success or failure in the motor carrier industry.

Methodology

This research is being conducted through open-ended interviews with key executives in a convenience sample of 22 motor carriers. These firms range in size from \$1 million to \$1 billion in annual gross

operating revenues. While the number of individuals to be interviewed varies with the size of the firm, the functions that they carry out are fairly stable. The CEO, the chief marketing strategist, the chief financial strategist, and the director of the firm's information system are usually interviewed. Where these duties are shared, combined under a single position, or ignored, the number of interviews is adjusted accordingly.

Each of the interviews takes approximately 45 minutes. While the interviews are open-ended, there are some questions which are designed to guide them. A copy of those questions is attached.

APPENDIX C

LIST OF TITLES OF INTERVIEW SUBJECTS

President
Chairman of the Board and Chief Executive Officer
Vice President, Purchasing and Maintenance
Senior Vice President, Marketing and Sales
Director of International Sales
Manager, Air Freight Division
Director of Marketing
Vice President, Marketing
Vice President, Finance
Executive Vice President
Vice President of Administration
Vice President, Information Systems
Vice President of Finance and General Counsel
Director of Strategic Planning
Vice President of Personnel and Administration
Comptroller
Director of Accounting and Finance

APPENDIX D

COMPUTER HARDWARE

IBM SYSTEM 34
BURROUGHS B-80
IBM SYSTEM 4331
IBM SYSTEM 4361
IBM SYSTEM 38
UNIVAC 1100
IBM SYSTEM 3031
WANG VS80
IBM PC XT
IBM 5120
VECTOR 420, 440
IBM 5110
IBM 5285
IBM 5643
HONEYWELL
IBM 3083
IBM 8081
IBM 738
APPLE IIE

VITA

After graduating from Northwestern University in 1972, Stephen A. LeMay served in the United States Air Force for six years. He earned the Air Medal and the Pushkin Award for outstanding study in the Russian Language. He began graduate study in Business and Transportation in 1979, earning a Master's in Business Administration, and with the completion of this dissertation, a Doctorate in Business Administration. His research and writing has appeared in the Transportation Journal and the Transportation Research Forum. In addition, he has performed consulting services in the steel industry and in services industries. His primary interests are in motor carrier and rail transportation.