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Top management perception of strategic information processing in a turbulent environment

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ABSTRACT

Extant strategic management literature provides only partial answer to the important question: What variables affect top managers' ability to process complicated, novel, ambiguous, or dynamic strategic information in a turbulent environment? Drawn upon cognitive psychology, personality theory, management theory, organizational theory, and management information systems literatures, this paper proposes that nine personal attributes and four contextual attributes affect top managers' information processing capability. The nine personal attributes are: cognitive complexity, knowledge, mental model of success, open-mindedness, time orientation, personal values, tolerance for ambiguity, locus of control, and time devoted to environmental scanning. The four contextual attributes are: rewards and incentives, culture, structure of strategic planning process, and executive support systems. Thirteen propositions are postulated regarding the types of attributes that are conducive for top managers' ability in processing complicated, novel, ambiguous, or dynamic information.

INTRODUCTION

One of the major problems confronting strategic management is that the external environments of many firms have become increasingly turbulent where prevailing environmental information is often highly complicated, novel, ambiguous, or dynamic. Top managers often misperceive environmental changes because they can not adequately process (that is to view, search, and interpret) information with the above characteristics (Ansoff & McDonnell, 1990; Wack, 1985b). Top managers who incorrectly perceive the environment have difficulty in formulating effective strategic decisions for their firms (Ansoff & McDonnell, 1990; Hatten & Schendel, 1976).

Thus, an important question may be raised: What variables affect top managers' ability to process complicated, novel, ambiguous, or dynamic information. Unfortunately, strategic

management literature provides very few answers to the above question. To provide a comprehensive answer, it is necessary to borrow insight gained from a multidisciplinary stream of literatures such as cognitive psychology, personality theory, and organizational theory.

The purpose of this paper is to propose a multidisciplinary model which integrates all relevant variables. Such a model, which is expressed in terms of thirteen propositions, can contribute to a comprehensive understanding of determinants of top managers' information processing capability.

This paper is divided into five sections. First, it discusses the background of the study. Second, it describes the characteristics of information in a turbulent environment. Third, it discusses the boundary conditions of the model and its assumption. Fourth, it outlines the relationships between the top managers' personal attributes and their ability in processing information. Fifth, it describes the relationships between the firms' contextual attributes and the top managers' ability in processing information. Last, it discusses the implication of the model.

BACKGROUND

To understand the variables affecting individuals' information processing capability, researchers have typically adopted two separate approaches: personal attributes or contextual attributes. Examples of personal attributes are cognitive complexity, open-mindedness, mental model of success, etc. Examples of contextual attributes are: organizational culture, organizational structure, etc. Each approach provides partial insight to the question investigated, but neither alone can offer a complete answer.

For instance, the personal attributes approach, drawn mostly from cognitive psychology, personality, management, and philosophy literatures, helps identify personal characteristics that can be used to predict individuals' information processing capability. However, this approach can not explain why individuals with similar personal characteristics from different organizations exhibit different information processing behaviors.

In contrast, the contextual attributes approach, drawn mostly from organizational theory and information systems literatures, contributes to the understanding of types of situational attributes that may either facilitate or damage the desired managerial information processing behaviors. Yet, it can not differentiate which managers within the firm possess better information processing capability than the others.

Furthermore, regardless of the approach used, scholars usually study the impact of only one or two attributes on individuals' information processing capability. However, each of these attributes is only useful for predicting certain aspects of the question examined. For instance, it is suggested that individuals' open-mindedness affects their acquisition and acceptance of novel information (Goldstein & Blackman, 1977). But it is not clear whether this personal attribute can predict individuals' differences in dealing with complicated, ambiguous, or dynamic information.

Therefore, to have a comprehensive understanding of determinants of top managers' information processing capability, it is necessary to integrate all relevant attributes from both the personal and contextual attributes approaches.

The characteristics of information in a turbulent environment are discussed next, because it is central to the suggested propositions.

INFORMATION CHARACTERISTICS

In the works of Emery and Trist (1965), Terreberry (1968), Thompson (1967), and Duncan (1972), two characteristics contribute to the uncertainty of the environment: complexity and dynamism. Complexity is defined as the number and diversity of external factors facing the firm. Dynamism is viewed as the degree of change exhibited in those factors.

Ansoff and McDonnell (1990) suggested that four characteristics contribute to the turbulence of the environment: a) Complexity. This characteristic refers to a variety of factors that management must consider when making decisions; b) Novelty. Here concerns are given to the discontinuity of successive challenges that the firm encountered in the environment; c) Rapidity of change. This is the ratio of the speed of evolution of changes to the speed of the firm's response; d) Visibility of the future. This is measured by the predictability of information about the future, available at the decision time.

Building on the above studies, this paper suggests that changes in a turbulent environment possess one or more of the following characteristics: high complexity, high novelty, high dynamism, and high unvisibility. High complexity requires top managers to consider a large number of factors from various environmental segments (e.g., competitive, economic, political, technological, global) to make decisions. High novelty means that relevant events and trends are discontinuous and unfamiliar to top managers. High dynamism indicates that relevant environmental factors are in a continuous process of change. High unvisibility means that by the time that top managers must make decisions, the content of available information is very vague and ambiguous.

Thus, the characteristics of information in a turbulent environment are complicated, novel, dynamic, or ambiguous.

A GLOBAL MODEL OF INFORMATION PROCESSING

As shown in Figure 1, top managers face a turbulent environment where prevailing information is highly complicated, novel, dynamic, or ambiguous. Based on the works of Aguilar (1967) and Hambrick and Mason (1984), top managers' information processing activities can be seen as involving three sequential steps:

Figure 1. A Global Model of Information Processing

First, "viewing" refers to top managers' exposure to the environment. It determines the scope (e.g., competitive, economic, technological, or political segments) of information that top managers' attentions are directed.

Second, "search" involves the acquisition of information. It affects the specific types of information (familiar vs. novel, hard vs. soft) that top managers are looking for. For example, some top managers orient their search activities toward familiar information concerning traditional competitors, while others orient their search activities toward both familiar and novel information related to traditional and non-traditional competitors.

Third, "interpretation" is defined as the analysis of information gathered. It determines whether information captured will be perceived to be relevant and valid. Interpreted relevant and valid information will then be fed into the strategic decision-making process of the firm.

Therefore, the information processing capability of top managers determines the quality (i.e., relevance, timeliness, accuracy) of information used in formulating strategic decisions. In this paper, such capability is hypothesized to be affected by nine personal attributes and four contextual attributes. The nine personal attributes are cognitive complexity, knowledge, mental model of success, time perspective, open-mindedness, personal values, tolerance for ambiguity, locus of control, time devoted to environmental scanning. The four contextual attributes are rewards and incentives, organizational culture, organizational structure, and executive support systems. Each of these attributes will be discussed in detail.

BOUNDARY CONDITIONS AND ASSUMPTION OF THE MODEL

The model applies to organizations whose information processing activities are characterized as informal and opportunistic; where the key actors are top managers. The model does not apply to organizations with organized and institutionalized information processing activities; where the key actors are top managers and scanning and interpretation staffs. In such organizations, information processing activities are more complicated and involve more steps. First, staffs scan the environment to gather information. Second, staffs apply formal interpretation methodologies to analyze the meanings of information collected. Third, staffs communicate interpreted information to top managers. Fourth, top managers accept or reject wholly or in part communicated information as relevant and valid information (Wang, 1991). Consequently, some attributes (e.g., locus of control, time devoted to environmental scanning) may become less important in affecting the quality of perceived relevant and valid information. However, attributes (e.g., qualification of scanning staffs, sophistication of interpretation methodologies, communication barriers between top managers and their staffs) which are not included in the model may become more important.

The suggested thirteen propositions apply to top managers of business firms. Some of the propositions (e.g., mental model of success, knowledge) may need modification if the units of analysis are top managers or top administrators of not-for-profit organizations.

High complexity, high novelty, high dynamism, and high ambiguity are assumed to adequately describe the major characteristics of information in a turbulent environment.

PERSONAL ATTRIBUTES

The usefulness of personal attributes in predicting top managers' ability to process complicated, novel, dynamic, or ambiguous information is discussed below and is summarized in Table 1.

Table 1

Predictors of Accuracy of Top Managers' Perceptions of Turbulent Environment	Characteristics of Information in a Turbulent Environment			
	High Complexity	High Novelty	High Dynamism	High Ambiguity
Personal Attributes				
Cognitive complexity				
- cognitive complex	X			X
Knowledge				
- Global opportunity & changes in the environment	X			
Mental model of success				
- Strategic positioning	X	X		
Open-mindedness				
- More open-minded		X		
Time orientation				
- future oriented		X		
Personal values				
- high change-seeking propensity		X	X	
Tolerance for ambiguity				
- High tolerance for ambiguity			X	X
Locus of control				
- Internal			X	
Time devoted to environmental scanning				
- Spend more time in scanning activities	X		X	
Contextual attributes				
Rewards and Incentives				
- Strategic positioning & innovation	X	X	X	
Culture				
- Strategic & creative		X		
Structure of strategic planning processes				
- Participatory	X		X	
Executive Support Systems	X		X	

Cognitive complexity. The concept of cognitive (or integrative or conceptual) complexity is rooted in the works of Schroder, Driver, & Streufert (1967) and Harvey et al. (1961), and has been extensively researched by cognitive psychology scholars over the past three decades. The concept measures the structure of cognition and includes two primary components: a) differentiation - which refers to number of dimensions used by individuals to perceive environmental stimuli; and b) integration - which refers to the complexity of rules used by individuals in organizing the differentiated dimensions.

Cognitively simple individuals tend to perceive stimuli in simple and minimally differentiated dimensions and to apply fixed rules for organizing stimuli (Schroder, 1971). On the contrary, cognitively complex individuals tend to perceive several dimensions in stimuli and to apply more complex rules to interpret phenomena (Yasai-Ardekani, 1986; Bartunek & Louis, 1987).

Other empirical studies show that cognitively complex individuals tend to: a) attend to broader ranges of information (Streufert, Garber, & Schroder, 1964); b) search for more information (Tuckman, 1964); c) spend more time in interpreting information (Dollinger, 1984; Sieber & Lanzetta, 1964); and d) thus have a more accurate perception of the complexity of environment when information load is intermediate (Streufert & Driver, 1965).

It can be inferred from the above theoretical arguments and empirical results that cognitively complex top managers are likely to attend to and search for broader range of information from various environmental segments such as industry competition, economic, political, technological, and international. They can better analyze the implications of complicated information gathered on the firms' business.

Cognitive complexity may also affect individuals' ability to process ambiguous information. Tuckman & Orefice (1973) defined cognitively simple individuals as being categorical, black-white thinking, averse to ambiguity. Dollinger (1984) suggested that cognitively simple individuals cannot deal with a wide variety of stimuli, thus they only focus on the least ambiguous information. On the contrary, an empirical study of Beechy (1984) showed that cognitively complex accounting students perform better on unstructured case materials. Based on the above studies, it is logical to expect that cognitively complex top managers will pay more adequate attention to ambiguous and vague information and can better evaluate their implications.

Proposition 1a: Cognitively complex top managers can better process complicated information than cognitively simple top managers.

Proposition 1b: Cognitively complex top managers can better process ambiguous information than cognitively simple top managers.

Knowledge. While cognitive complexity is concerned with the structure of cognition, knowledge deals with the content of cognition. Structure refers to the manner in which our thinking is organized; content refers to what information is available. Therefore, the two concepts complement each other. The concept of knowledge is originated from learning theory literature, and it is defined as areas of competence which are most important for managers' success in their careers (Ansoff & McDonnell, 1990). Knowledge develops primarily from educational background and work experience (Fiske & Linville, 1980).

Managers' knowledge of (familiarity with) the information received influences their ability to recognize the relevance and importance of this information (Aguilar, 1967). Learned, Ulrich, and Booz stated that "To be received readily, new information and ideas usually have to be fairly consistent and compatible with what is already known and understood" (1951, p. 38). Managers with interdisciplinary background are ideal candidates for performing scanning and interpretation tasks in a turbulent environment (Fahey, King, & Narayanan, 1981) where the scope of relevant information is broad.

It is expected that top managers whose knowledge is composed of mainly internal politics and operations, are likely to pay more attention to and search for information generated inside the firm. They probably have no difficulty in analyzing the meanings of such information, because this information is familiar to them. However, when confronted with external information (which is usually more complicated than internal information), they often lack the necessary knowledge to interpret the implication of this information.

Conversely, top managers whose knowledge is composed of global opportunities and changes in the environment are likely to attend to and collect information generated in the various external environmental segments, and their broad knowledge enables them to better assess the relevance and importance of complex information collected.

Proposition 2: Top managers whose knowledge is composed of global opportunities and changes in the environment can better process complicated information than managers whose knowledge is composed of internal politics and operations.

Mental model of success. As managers respond to environmental stimuli, they encounter successes and failures. Over time, accumulated successes form a belief in the managers' minds about "things that do work." Similarly, failures build a belief about "things that do not." Together, the two sets of beliefs evolve into a mental model of success. The model contains important variables, cause and effect relationships among these variables, and action alternatives which are believed to produce success in the environment (Ansoff & McDonnell, 1990).

The concept of mental model of success in the management literature is similar to the concepts of cognitive map (Axelrod, 1976; Schwenk, 1988), belief structure (Walsh, 1988), and schema (Bartlett, 1932) in the cognitive psychology literature. It is also similar to the concept of frame of reference in the sociology literature (El Sawy & Pauchant, 1988). Managers' mental model of success affect their viewing, search, and interpretation behaviors in the following ways:

First, it determines the scope of information to be attended to or to be neglected (Weick, 1979; Nystrom & Starbuck, 1984; Neisser, 1976).

Second, it reduces the complexity of environmental signals by searching for what really matters (Wack, 1985b; Treacy, 1986; Schwenk, 1988; Ansoff & McDonnell, 1990). In other words, it guides the information search.

Third, it affects the interpretation of information collected (Dutton et al., 1983). Top managers frequently interpret information as irrelevant when they are at substantial variance, or contrary to their mental model of success (Ansoff & McDonnell, 1990).

In order to examine the effects of a mental model of success on managerial information processing, its content must be established. Building upon Dearborn and Simon's (1958) logic of departmental identification, Walsh (1988) hypothesized that managers hold their mental model of success (belief structure) around attributes (e.g., economy of scale, R & D capability, market share, etc.) they believe characterize a successful organization. Ansoff and McDonnell (1990) referred to mental model of success as managers' beliefs of types of strategy that are most important to the success of the firm. This paper adopts Ansoff and McDonnell's approach, because it encompasses the approach of Walsh (1988).

Two different types of mental model of success, the efficient production strategy and the strategic positioning strategy, are used to illustrate their impact on top managers' viewing, search, and interpretation behaviors. Production-oriented top managers believe that the firm's successes rely on aggressive construction of efficient-scale facilities, vigorous pursuit of cost reduction from experience, tight cost and overhead control, and cost minimization in areas such as R & D, service, sales force, advertising, and so forth (Porter, 1980). Therefore, these managers tend to devote more effort in attending to and acquiring internal information which are relatively simple, familiar, and past oriented (Govindarajan, 1989). Such a tendency makes them less able to identify important variables when dealing with complicated external stimuli. Moreover, when faced with novel stimuli such as information regarding marketing and R & D, these managers are inclined to interpret them as irrelevant or unimportant, or they lack competence for evaluating this information appropriately.

The strategic-oriented top managers believe that the firm's successes depend on strategically positioning businesses in the most profitable areas and maintaining the flexibility of operations. Thus, they are alert to a wide range of environmental changes and they gather information extensively. They are skilled in identifying and interpreting the important variables among complicated external issues. Furthermore, they do not assume that the future repeats the past. They are skillful in perceiving the underlying trends that will make the future different from the past. They subsist on novel and unfamiliar change (Ansoff & McDonnell, 1990).

Proposition 3a: Strategic-oriented top managers can better process complicated information than production-oriented top managers.

Proposition 3b: Strategic-oriented top managers can better process novel information than production-oriented top managers.

Open-mindedness. In cognitive psychology literature, open-mindedness (Rokeach called this attribute dogmatism) is concerned with individuals' openness toward novel stimuli and ideas. An individual's beliefs may be held in an open or closed system, independent of the content of those beliefs. A person who is open-minded (low dogmatic) in one area is likely to be open-minded in other areas (Rokeach, 1960).

Researchers have hypothesized that the more open-minded are individuals, the more they are likely to seek out and accept information that is inconsistent with their beliefs. This hypothesis has been supported by the empirical studies of Durant and Lambert (1967), Hunt and Miller (1968), Feather (1969), and Osborn (1973). Similarly, it has been hypothesized that the more open-minded are individuals, the more receptive they will be to novel stimuli. This hypothesis was substantiated by the empirical studies of Miller and Bacon (1971) and Zagana and Kelly (1966).

It should be noted that not all empirical evidences supported the above two hypotheses. The contradictory findings probably are due to the fact that an individual defined as less open-minded in one study may be defined as more open-minded in another (Goldstein & Blackman, 1977). However, enough empirical results and intuitive appealing of the theoretical arguments make it sufficient to advance the following proposition:

Proposition 4: Top managers who are more open-minded can better process novel information than top managers who are less open-minded.

Time orientation. In management literature, time orientation refers to the time frame top managers use to deal with environmental changes. Past (historical)-oriented top managers assume that the future repeats the past, and they rely on established procedures or policy to manage changes. Conversely, future-oriented top managers do not assume that the future repeats the past, and they identify or create future opportunities (Ansoff & McDonnell, 1990).

Therefore, it is logical to assume that past-oriented top managers are more likely to attend, search, and feel more comfortable with analyzing retrospective and familiar information. In contrast, future-oriented top managers are more inclined to orient their viewing, search, and interpretation activities toward prospective and novel information.

Proposition 5: Future-oriented top managers can better process novel information than past-oriented top managers.

Personal values. According to England (1967), personal values affect the selection, filtering, and interpretation of what in individual "sees" and "hears." A number of strategic management scholars (e.g., Sturdivant, Ginter, & Sawyer, 1985) indicated that personal values of top managers influence the recognition and interpretation of environmental forces.

Change-seeking propensity is an aspect of personal values which may have an impact on top managers' information processing behavior (England, 1967; Wilson, 1973; Sturdivant et al., 1985). In his study of conservatism/liberalism, Wilson (1973) defined conservatism as resistance to change, and liberalism as preference for change. He concluded that top managers who resist change do not like to search for novel information. These managers feel threatened or anxious when responding to uncertainty and novelty. Sturdivant et al. (1985) noted that top managers who resist change tend to interpret novel changes as irrelevant or unimportant.

It can be inferred from the above that top managers who have preference for change like to search for novel information. These top managers feel more comfortable and are more receptive to novel signals.

Proposition 6: Top managers who have preference for change can better process novel information than top managers who have a tendency to resist change.

Tolerance for ambiguity. In cognitive psychology literature, tolerance for ambiguity is concerned with the degree to which people can hold back their need for a perfect clear view of the environment (Adorno, Frenkel-Brunswick, Levinson, & Sanford, 1950). The reason that many top managers having difficulty in dealing with ambiguity (uncertainty) is partly historical. Many top managers developed their skills in the 1950s and 1960s, a period characterized by a high level of economic predictability. Being competent then meant knowing the right answer; it was considered as incompetent or unprofessional to say, "Things could go this way - or that." (Wack, 1985b)

Individuals with low tolerance for ambiguity prefer definiteness and regularity (Goldstein & Blackman, 1977). In other words, they like to deal with hard (quantitative) data. Such a preference may lead them to perceive the environment less ambiguous than it really is. In contrast, individuals with high tolerance for ambiguity feel more comfortable with handling soft (qualitative) and vague data. Therefore, they are more likely to have a clear view of the ambiguity in the environment.

Individuals with low tolerance for ambiguity may prematurely close their information processing activities, and they are rigidly impervious to new information (Frenkel-Brunswick, 1949; Janis et al., 1969). Conversely, the empirical study of Dollinger (1984) showed evidence in support of a hypothesis that entrepreneurs with higher tolerance for ambiguity tend to spend a larger proportion of their time in performing environmental scanning activities. Thus, it is reasonable to expect that top managers with high tolerance for ambiguity are more likely to keep up with rapid environmental changes than top managers with low tolerance for ambiguity.

Proposition 7a: Top managers with high tolerance for ambiguity can better process ambiguous information than top managers with low tolerance for ambiguity.

Proposition 7b: Top managers with high tolerance for ambiguity can better process dynamic information than top managers with low tolerance for ambiguity.

Locus of control. In the personality literature, Rotter's internal-external locus of control scale measures individuals' perception of how much control they are exerting over the events in their lives. Internal persons believe that the outcomes of their behaviors are the results of their own efforts. In contrast, external persons believe that the events in their lives are beyond their control and should be attributed to fate, luck, or destiny.

Previous empirical research has concluded that internals and externals exhibit different information-processing behaviors. In particular, these studies have found that internals are more proactive in the acquisition and utilization of information than externals. Govindarajan (1989) attempted to explain the logic behind these findings. He suggested that internals, possessing a higher generalized expectancy, perceive acquisition and utilization of relevant information as a significant determinant of task outcomes. Externals, on the other hand, possessing the generalized expectancy that their own efforts are not crucial in the attainment of rewards, are not expected to actively seek and use information. Thus, internals are more likely to keep up with fast changing events and trends than externals.

Proposition 8: Internal top managers can better process dynamic information than external top managers.

Time devoted to environmental scanning. The empirical studies of Fahey, King, and Narayanan (1981) and Diffenbach (1983) showed that time pressure of operating concerns pre-empts attention from strategic information search and interpretation activities. March and Simon (1964) suggested that selective attention is most acute when the time is shortest.

Therefore, it can be expected that top managers who devote a small proportion of their time to environmental scanning activities are likely to pay attention to information that meet their immediate and narrow concerns. The nature of search activities is likely to be reactive. Consequently, they will have difficulty in keeping up with rapid environmental changes.

In contrast, top managers who devote a larger proportion of their time to environmental scanning activities are likely to acquire a broader range of information concerning events and trends from various environmental segments. Furthermore, the mode of search activities is likely to be proactive.

Proposition 9a: Top managers who devote more time to environmental scanning can better process complicated information than top managers who devote less time to environmental scanning.

Proposition 9b: Top managers who devote more time to environmental scanning can better process dynamic information than top managers who devote less time to environmental scanning.

Table 1 summarizes profile of top managers that can be used to predict their ability in processing complicated, novel, ambiguous, or dynamic information. However, it is possible that top managers with similar personnel profiles may exhibit different information processing behaviors, because organizational factors either reward or punish top managers to exercise their information processing potential. Therefore, to have a complete view of factors affecting top managers' information processing capability, it is necessary to take into account contextual attributes.

CONTEXTUAL ATTRIBUTES

The usefulness of contextual attributes in predicting top managers' information processing capability is discussed below and is summarized in Table 1.

Rewards and incentives. Top managers' enthusiasm in engaging in strategic information viewing, search, and interpretation activities is influenced by the manner in which they are rewarded (Diffenbach, 1983). The composition of top managers' compensation package sends a signal to them about which behaviors are more likely to be rewarded (Finkelstein & Hambrick, 1988).

It is expected that top managers whose rewards are based mainly on length of service and/or short-term efficiency of performance will either lack motivation in performing strategic information processing activities required in a turbulent environment or they will only attend to and search for familiar and internal information.

In contrast, top managers whose rewards are based primarily on contribution to strategic positioning and/or product/market innovation are likely to monitor broadly, proactively, and frequently to identify opportunities and threats. They are inclined to pay more attention to novel environmental changes.

Proposition 10a: Top managers whose rewards are based mainly on their contribution to strategic positioning and/or product/market innovation can better process complicated information than top managers whose rewards are based mainly on efficiency of performance and/or length of service.

Proposition 10b: Top managers whose rewards are based mainly on their contribution to strategic positioning and/or product/market innovation can better process novel information than top managers whose rewards are based mainly on efficiency of performance and/or length of service.

Proposition 10c: Top managers whose rewards are based mainly on their contribution to strategic positioning and/or product/market innovation can better process dynamic information than top managers whose rewards are based mainly on efficiency of performance and/or length of service.

Organizational (top management group's) culture. This attribute is concerned with the basic assumptions, beliefs, frame of reference, and desirable behaviors that are shared by members of an organization (Schein, 1985; Shrivastava & Schneider, 1984).

Different organizational cultures are disposed to search for different information and learn about different things (Thompson & Wildavsky, 1986). Shared beliefs about a firm's environment lead the firm to establish systems and specialists to monitor certain kinds of environmental information and not others. The domains that are monitored generate information within the

firm that reinforces beliefs about the environment (Starbuck, 1976; Sproull, 1981). Therefore, different cultures perceive the environment differently.

Organizational culture affects managers' perceptions of the environment in both a more subtle way and a more obvious way. On one hand, culture acts like a filter through which managers "see" the nature of environment in a certain way (Schein, 1985). In this case, managers are not very conscious of culture's impact on their perception. On the other hand, managers may actively suppress their personal view of reality in favor of a view acceptable to firms' leaders and traditions (Janis, 1972).

Firms that operate in a stable environment nurture a conservative and production-oriented culture, which in turn tend to perceive the environment as stable. This shared belief will induce its members to notice, search, and accept mainly familiar information. Perceived novel information that is contrary to the prevailing belief of the culture will be filtered out. In contrast, firms that operate in a turbulent environment cultivate a strategic and creative-oriented culture. Such culture will not constrain its members to perceive the environment in a certain way. Perceived novel information will be studied carefully.

It is suggested that the top management group's culture exerts more influence on the information processing capability of individual top managers than the organizational culture in general.

Proposition 11: A strategic and/or creative-oriented top management group's culture is more conducive to individual top managers to process novel information than a stability and/or production oriented top management group's culture.

Structure of strategic planning process. Structural characteristics such as decentralization, participation, interaction, and formalization act like filters and limit what organizational members can see (Weick, 1969; Miles, Snow, & Pfeffer, 1974; Leifer & Huber, 1977). The sensorial capacity of the structure in large part controls the quality of information received and the speed of its transmission. Research showed that decentralized structures tend to respond rapidly to changes, while centralized structures restrict the perceptual ability of the organization as well as the flow and speed of communication within it (Thompson, 1967; Lawrence & Lorsch, 1967).

According to Milliken (1990), participation of strategic decision-making responsibilities allows top managers to be exposed to the opinions of others who may be more active boundary spanners than themselves. These boundary spanners are likely to participate in external networks to exchange information about environmental trends and their potential significance. Therefore, she found that the more participatory an organization's strategic planning process is, the more likely top managers will be to notice the occurrence of an environmental change in a more timely manner.

Structural characteristics such as high levels of participation and interaction and a low level of formalization are conducive to a high level of information processing (Galbraith, 1973)

and facilitate extensive use of information (Daft & Weick, 1986). Thomas and McDaniel (1990) found that when top management teams possess the above three structural characteristics, individual top managers are likely to use more variables for interpretation.

Proposition 12a: A participatory strategic planning process is more conducive to individual top managers to process dynamic data than a non-participatory strategic planning process.

Proposition 12b: A participatory strategic planning process is more conducive to individual top managers to process complicated data than a non-participatory strategic planning process.

Executive Support Systems (ESS). Although the development of ESS is only a recent phenomenon, it has shown the potential to help top managers to stay abreast of rapid and complicated environmental changes. ESS is defined as a comprehensive computer-based support system that serves the information needs of top managers. It provides rapid access to timely information. It includes analytical capabilities. It is very user-friendly, supported by graphics, and provides exceptions reporting and "drill-down" capabilities. It is also easily connected with on-line information services and electronic mail.

The installation of ESS will force top managers to rethink through their information needs in a complicated environment. ESS can track an extensive number of publications. Some users indicated that they could not have covered so many periodicals personally without the system. Enhanced with expert systems, ESS will help in "knowledge sharing," increasing the scope of information collected (Elofson & Konsynski, 1990). ESS can assist top managers to explore the cause and effect relationships of complicated information gathered by including analytic and modeling capabilities. ESS can help top managers understand more complicated issues by presenting information in more meaningful formats (e.g., graphics, combining text and numbers, using hypertext). This will assist top managers comprehend their business by highlighting, for example, trends they might not have recognized with just tabular information.

ESS helps top managers to get through the scanning process in a fraction of the time it would otherwise take and to quickly determine which articles to read. By linking to an external database, ESS enables timely access to external information possible. Its communication capabilities facilitate the sharing of information among corporations in a rapid manner.

Proposition 13a: Top managers who use ESS can better process complicated data than top managers who do not use ESS.

Proposition 13b: Top managers who use ESS can better process dynamic data than top managers who do not use ESS.

DISCUSSION

The accuracy of top managers' perceptions of the turbulent environment rely on their ability to process information which is complicated, novel, ambiguous, or dynamic. However, to date strategic management literature has paid very little attention to factors affecting top managers' ability to process information with the above characteristics.

Borrowing insights gained from cognitive psychology, personality, philosophy, management, organization theory, and executive support systems literatures, this paper suggests a comprehensive profile that can be used to predict top managers' information processing capability. The profile is composed of two parts: nine personal attributes and four contextual attributes. Although throughout this paper these attributes are believed to be useful in predicting the information processing capability to top managers, the same attributes can also be helpful in assessing those of personnel whose primary responsibility is to engage environmental scanning and interpretation activities (e.g., scanners and planners).

Some of the propositions developed in this study are based on the accumulated results of empirical studies. The subjects of these studies sometimes are non-managers. Other propositions are developed on the basis of reasoning. Therefore, the validity of propositions are subject to the test of empirical studies in a corporate setting. Nevertheless, these propositions provide a point of departure for holistic empirical research on top managers' information processing capability.

Assuming that all of the propositions are supported by empirical results, a practical question may arise: What to do if the firm can not find a top manager who possesses all the nine personal attributes? A possible solution is that the firm can find several top managers whose personal attributes complement one another.

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