Technology-Assisted Strategic Management: Proxy for Effective Management Practice

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A GDSS model incorporating group process theory is proposed. Theory in social psychology suggests that better decisions and enhanced outcomes result when certain group processes are overcome, and when other group processes are enhanced. The proposed GDSS model incorporates these theoretical perspectives in its design. Use of the proposed model may inform practitioners and researchers about strategic renewal, and may be useful in understanding dimensions of resource-based and strategic groups perspectives. Implications for management and for future research in GDSS and strategy are discussed.

Group decision support systems (GDSS) presume that groups need help in performing group task activities, and are therefore designed to improve group effectiveness (McGrath & Hollingshead, 1993). However, it is not clear that GDSS do improve group effectiveness, since mixed findings have emerged from research (Joyner & Hoder, 1994; McGrath & Hollingshead, 1993; Nunamaker, Dennis, Valacich, Vogel & George, 1993; Zigurs, 1989).

Equivocal findings may have arisen because much of the recent focus on GDSS deals with technical aspects of groupware design. These include considerations such as complementary hardware and networks, variable user-defined interfaces, user programmer capability, integration of other databases, document development and editing capabilities, etc. Technical characteristics reveal "how" such systems might work. But a focus on these dimensions diverts attention from fundamental, theoretical principles which precipitate the underlying interest in GDSS. These principles direct attention to "why" GDSS are designed the way they are.

This paper focuses upon process considerations underlying the design of GDSS. Group decision making research in social psychology has traditionally focused on group processes which both facilitate and impede effective decisions. While "process gain" results from pooling individuals into a group in the first place, actual group productivity falls below potential productivity because of "process loss" (Steiner, 1972). Theoretical and empirical work in social psychology has identified substantive sources of process loss. Process support and process structure mechanisms provided by GDSS should help to overcome sources of process loss (Nunamaker, et al., 1993). Therefore, a GDSS model built on these theoretical considerations is proposed.

Understanding GDSS design is increasingly important for the practice of management. Large firms such as General Motors now rely upon electronic systems which provide ease of communication among managers in remote and disparate divisions, or which serve to better connect suppliers and customers (Wilke, 1995). Andersen Consulting uses Lotus Notes to link together 20,000 consultants worldwide in a "knowledge exchange" database; the system enables

the entire consultancy group to be instantaneously updated on advances in management practice which are developed in any one location (Cortese, 1995). More broadly, much of the future growth in the technology sector is expected to come from widespread use of electronic information exchange systems by companies, and many potential competitors are gearing up to move into this market. Both developers and users of GDSS stand to benefit from a stronger theoretical design foundation for such systems.

GDSS designed around process theory considerations may be particularly useful for strategic decisions made by top management teams. Strategy process has long been a distinct and important domain within the field of strategic management research (Andrews, 1971; Ansoff, 1965; Huff & Reger, 1987; Pettigrew, 1992). Strategy process encompasses individual-group relationships (Chakravarthy & Doz, 1992). Critically, it includes the domain of strategic decision making (Huff & Reger, 1987). Effective strategic decision making by top management teams has been explored within the context of team demography (Eisenhardt, 1989; Hambrick & Mason, 1984), consensus (Bourgeois, 1980; 1985; Dess & Origer, 1987; Priem, 1990; West & Meyer, 1994), politics (Cyert & March, 1963; Eisenhardt & Bourgeois, 1992), and environmental and structural fit (Koberg, Tegarden & Wilsted, 1992; Priem, Rasheed & Kotulic, 1992). However, such studies have not examined the group dynamic affecting interactions between team members, which is what GDSS are designed to supplement or replace. Therefore, in this paper a GDSS model built on theoretical process considerations is proposed, and an example of a strategic decision is discussed in the context of the proposed model. More generally, the implications of the model for other domains of interest to strategy researchers and practitioners are explored.

Group Process Theory Informs GDSS Design

At the outset it must be acknowledged that "groupware" is only a tool for enhancing group process. It is not a decision-maker; it cannot create or force agreement among

participating members. But through its design GDSS may be able to overcome problems typically associated with group processes which impede effective decision making. These problems include reliance by decision making groups on incomplete information, and relatedly the influence of agendas on group discussions and outcomes. GDSS may also enhance certain positive group processes which lead to better decision-making, such as causal mapping leading to cohesiveness, laying the groundwork for mutual understanding and consensus, and helping to establish a common language or frame.

Overcoming Process Loss

Certain elemental group processes seem to impede effective decision making by groups. One of these is the tendency of groups to focus discussions on information which members of the group already share. Most real world groups work together under conditions of partially-shared information. In these situations members possess information identical to that possessed by others, but most members also possess unique information not possessed by others. Stasser et. al. (1980) have shown, however, that a greater probability exists for groups to choose an alternative associated with the commonly-shared information. This may result in part because conflictual situations do not facilitate fact-finding behavior among group members (Stasser & Titus, 1985). Supporting this point of view is Laughlin's (1980) research showing that the content of discussions is biased in favor of shared information.

Thus the distribution of information within the group dramatically impacts final group outcomes (Stasser, et al., 1980; Stasser & Titus, 1985). To the extent that all group members possess similar information or knowledge, such information or knowledge will be relied upon for decision making. To the extent that information or knowledge is not shared among all group members, such information or knowledge will be factored into group decisions less often.

Certain dynamic group processes block unshared information and minority points of view from surfacing. Groups are subject to both the monopolization of conversation by a few (Bales & Strodtbeck, 1951) and the centralization of communications (Hill, 1982). Communication

centralization refers to the degree of organization of a group's communication network (Scott, 1991); the more organized a network, the less opportunity for conversations and discussions outside the focal interests of the network. In addition, discussion floor conditions exist, and there are motivations not to break the floor by individual members. Finally, the formation of factions and subgroups among group members (Hastie, Penrod & Nancy, 1983) affects the content of group discussions. In sum, these dynamics tend to prompt less powerful or less influential group members to refrain from contributing. Dissenting or minority points of view and new perspectives are thus prevented from entering into discussions and being legitimately considered by the entire group.

As a result, under ordinary conditions groups tend to consider only alternatives to which they are initially biased. Because groups tend to rely on that information which is already shared and not bring to discussions novel information which may inform choice, a polarization of opinion occurs among group members in the direction of initial beliefs and opinions (Stasser & Titus, 1985; Stoner, 1961). Group members tend to move away from alternative or compromise positions toward existing choice positions. These choice positions are those they initially favored, and reflect their biases before group discussions were entered into.

Furthermore, the context in which groups operate affects the extent to which new information is brought to bear in decision making. The tendency to discuss information or issues already shared increases when groups are confronted with high information load and a high percentage of new, unshared information (Gigone & Hastie, 1993). Ambiguity and uncertainty are conditions which create a high information load, and which often characterize the realm of strategic decision making (Mintzberg, Raisinghani & Théoret, 1976).

The implications of these perspectives for strategic decision making and thus for GDSS models used for strategic issues are important. Since sound strategy requires ongoing adaptation of the firm to its changing environment (Chakravarthy, 1982), new perspectives on the changing environment need to enter into strategic discussions. Biased strategic discussions which rely on historical information for making strategic decisions may result in strategic drift (Hamel &

Prahalad, 1994; Johnson, 1988) or ultimately inertia leading to the need for revolutionary change (Tushman & Romanelli, 1985). West (1995), for example, has shown that critical aspects of the strategic change process reside in the ability of groups to encourage the generation of strategic alternatives by group members who are less central in the communication network, and in particular those who are less attached to the status quo of the organization. Often these are not the top management team CEOs/presidents (West, 1995). Thus GDSS models need to explicitly incorporate a process which encourages the use of unique information and opinions in discussions. In the model proposed below, group members are given the opportunity throughout a discussion to bring new information and unique perspectives to bear in consideration of the issue at hand, without being burdened or constrained by any of the impeding processes described above.

Related to conditions of partially-shared information is the potentially deleterious effect of agenda influence on group discussions and decisions. Research on agenda influence has demonstrated that different outcomes may result from the use of different agendas within decision making groups (Levine & Plott, 1977). An agenda which pits more desirable alternatives against less desirable alternatives (from one subgroup's point of view) may mask true member preferences and result in a "manufactured" group decision (Levine & Plott, 1977). (For example, the presentation of A versus B as the first agenda item may result in the selection of A, followed by A versus C as a subsequent consideration; whereas the presentation of A versus C as the first agenda item may result in the selection of C, followed by B versus C as the subsequent consideration). Thus the individuals within groups who set the agenda and control the flow of discussion would appear to have the power to mold the outcomes.

Agenda influence suggests the more important issues perceived by the top management team will be those set by the leader of the team or by other powerful team members. CEOs are in "positions that allow them to shape group activities; in so doing, they may amplify, nullify, or moderate" issue importance (Jackson, 1992: 370). As a result, the CEO has the ability to affect the information and issues shared with and attended to by top managers. Politics and resource

dependence among top management team members may also result in powerful others (Eisenhardt & Bourgeois, 1988) impacting strategic discussions.

Because strategic agendas exist (Bowman & Bussard, 1991; Dutton, 1988), top management team members are directed to attend more to certain issues, minimize attention on some, and spend no time on others. Within the socially accepted set of issues on the strategic agenda, a prioritization exists which deems that some issues receive greater top management attention than others (Bowman & Bussard, 1991). Among the sets of all possible issues "priorities define what is important to decision makers" (Wooldridge & Floyd, 1989: 300). Since decision making groups tend to focus on shared information, the top management team will tend to focus on those issues which have been communicated as priorities for the CEO or powerful team members.

The implications of agenda effects are also important for strategic decision making and for GDSS which supports such decisions. As described above, an organization's ability to successfully adapt demands that emerging strategic issues be identified and appropriately considered by top management. Properly designed GDSS may overcome ordinary group processes which inhibit this ability. In the proposed GDSS model which follows, a presentation agenda is not set by any individuals. The group is not at any time asked to pit limited sets of alternatives against other sets. A program runs automatically, and thus avoids the use of a leader or of a chauffeur to control which issues are discussed, or if progress or public information is displayed to all group members. The proposed GDSS program also assigns identifying letters randomly to participants so that complete anonymity in shared information is maintained. While evidence suggests anonymity does not affect group results (Hiltz, Turoff & Johnson, 1989), in this way the possible influences of position, power, longevity, and expertise are eliminated.

The proposed model does not allow for information to be targeted by choice to specific individuals within the group. Any information offered by an individual goes to the entire group; the only individual-to-individual communication is directed by the program itself. As a result this process disallows intentional faction formation and political lobbying for position.

Enhancing Process Gain

Certain group processes which tend to result in better decisions might be enhanced by GDSS. Festinger (1950) suggests that enhanced communication between disagreeing members moves groups toward uniformity or consensus. Building consensus for strategic decisions in an organization is held to be an important variable contributing to enhanced firm performance (Bourgeois, 1980; Dess, 1987; 1995; West & Meyer, 1994). Therefore a groupware process which identifies disagreeing members and then facilitates communication between them preserves this principle for effective natural group dynamics.

There is, in addition, some evidence that solution-oriented groups perhaps move too quickly toward a decision, while problem-oriented groups more effectively examine the relevant issues and considerations (Hill, 1982). For strategic decision GDSS attention to differences between members will help maintain a focus on the problem issues which need to be resolved for a better group decision to emerge.

An integral part of moving toward a group decision lies in enhancing group cohesiveness (Festinger, 1950). While the promotion of fully shared information may be one method for overcoming initial biases, members may still differ in opinions and desired choices. Festinger (1950) hypothesizes that greater communication between disagreeing members contributes to greater cohesiveness, but does not suggest the nature of that communication. The illustrated groupware model presented here suggests the understanding of reasons for differences between members might lay the foundation for building cohesiveness. This model thus includes a form of causal mapping of members' preferences (Diffenbach, 1982; Eden, 1989) and differentiates levels of importance of causal linkages (Heintz & Acar, 1992). In exploring causal differences and differences of degree in causal linkages, group members would be able to move beyond pure informational summaries and into substantive sources of disagreement. In this fashion differences of opinion may be traced back to differences in paradigms used by managers to

interpret and evaluate decision alternatives. Exposure to paradigmatic reasoning will facilitate a better understanding of differences among the group. It may also prompt occasions for exploring the incommensurability of paradigms, and thus lead to breakthroughs to a new mode of management (Kuhn, 1970).

Similarly, groupware should facilitate the establishment of a common language or set of criteria which can be used as a frame for evaluating choices and the importance of causal linkages (Tversky & Kahneman, 1981). In the proposed program this is accomplished by establishing "evaluation categories" at the beginning of the process, defined here as key objectives or criteria by which solution alternatives will ultimately be evaluated. Thus by establishing a common framework and by seeking the underlying causal reasons behind opinions, the process seeks to build cohesiveness among group members.

Theory-Based GDSS Model

The previous section has developed background based on theory and empirical research for the design of an effective GDSS system for strategic decision making. This section outlines a design building on these perspectives, and illuminates the workings of the design using an example of management making a type of decision.

Assume a top management group in a company is convening to resolve how to invest surplus cash. Convened in the group are the president as well as the vice presidents from finance, accounting, operations, marketing, sales, and R&D. Each member of the team is seated in front of a computer terminal, on which the GDSS runs. There is no direct face-to-face interaction between members once the GDSS program starts up.

Figure 1 portrays the GDSS model and process. Displays and instructions appearing on individual computer screens alone are listed in column A, while displays of information available to all members are listed in Column B.

Insert Figure 1 about here

For this discussion it is assumed that the problem which the group must address is well-defined enough so that the system can succinctly state it as an opening in the process (first box in column B). Of course, sometimes the problem is not well-articulated; in these cases the groupware process itself might be helpful in first defining the problem.

Steps 1A - 1B. The first step is for members individually to list what they believe are the critical evaluation criteria to be used in making a group decision on this particular issue, and to rank each criterion on some standardized scale of importance (1A). The program then displays to all members the list of all criteria created by members, in order of importance assigned by members (1B). For instance, in the current example evaluation criteria might be effect on net income, payback period, and consistency with fundamental strategic direction.

The diagram shows a recursive relationship from 1B back to 1A. While establishing evaluation categories or objectives may not be difficult, as with problem definition in some instances there may be substantial disagreement between members. The recursive relationship shown simply acknowledges here a need to establish some common frame before moving on to problem-solving. The recursive process will allow members to modify category descriptions and the importance of categories, and in essence establish a common language for subsequent evaluation.

Another beginning issue is agreement on a decision rule to be used by the group. Some groups may operate on a single rule across all types of issues; for some groups the rule may vary depending on the nature of the issue. The notion of establishing the rule is important for the program in two ways. First, the program periodically calculates and displays measures of disparity or separation between members. The program will continue to iterate through various modes until the established decision rule level of agreement is reached. Secondly, it would seem important for members to have an objective they are striving for as a decision-making group, in addition to objectives established for the issues. Having a group process goal will facilitate the

sense of positive progress and of an emerging consensus as the process moves along (Earley, Connolly & Ekegren, 1989; Festinger, 1950; Kumar, Langford & Rediker, 1992).

Steps 2A - 2B. Following the establishment of a foundation with evaluation categories and a decision rule, individual members are asked to list solution alternatives to the problem (2A). Without the dominance of individuals in a round-table group discussion, the anonymous and equal environment should encourage putting on the table a diverse range of alternatives. For example, finance may wish to drop all spending to the bottom line, sales wants to hire new regional sales managers, R&D would like to buy new lab equipment, marketing would like to blitz advertising in key markets. In 2B the program lists for public display all alternatives generated by members.

Steps 3A - 3B. Each individual is now asked to rate each solution alternative from 2B on a scale of support (3A). A window listing all alternatives is presented to each member during this step. Individuals rate each alternative using a 7-point Likert-type scale (e.g. "very strongly support"). An eighth selection would flag an alternative as a restatement/duplication of another alternative, and would trigger the system to exclude the rating from averages calculated in 3B.

After all individuals have completed their rating tasks, the alternatives and their ratings are then displayed to the group as a whole (3B). Ratings displayed to the group include the average rating and the range for each alternative. The group as a whole for the first time is able to see how close or far apart they are. On their individual screens members see the group screen output; but in addition to the average and range scores, their own score for each alternative is listed, so that they may see where they stand with respect to the rest of the group. Those who are far off from the group might be prompted to reflect to a greater extent on the reasons why.

Steps 4A - 4B. Individuals are now prompted to list key reasons for their ratings of each alternative, and to indicate whether each reason is a positive or negative characteristic for the alternative (4A). In the example finance may list "improvement in stock price due to higher profitability (+)" and "additional cash on hand at year end (+)" related to their preferred alternative. At the same time they might list "already spent higher % of sales on advertising than

ever before (-)" related to their poor rating of the solution alternative proposed by marketing for increased advertising. Solution alternatives and the reasons offered for each alternative (separated into pros and cons) are then displayed to all members (4B).

Steps 2 and 4 overcome problems of partially shared information and conversational control by the few. The initial listing of solution alternatives by members will tend to reflect their biases and biased information which they hold. Step 4 allows individuals to express reasons why they prefer certain alternatives and do not prefer others. Critical information they have, which others do not share, should come out in this stage and become available to the group as a whole. Importantly, this type of information comes out before the group has an opportunity to focus on shared information. These steps should overcome process loss due to inferior aggregation and integration of information within face-to-face groups.

Step 5A. In this step the list of alternatives/reasons are displayed on each member's screen, and members are asked to perform two tasks. First, each rates the importance of each reason within each alternative. Then after all reasons have been considered, each individual must re-rate each alternative solution based on viewing the composition of reasons from the group. For the first time a member is asked to specifically consider the merit of reasons offered in support of each alternative, to work through each reason, and to assess the importance of each. The focus of attention on the importance of each reason offered collectively by the group forces members to attend to all information pooled by the group in the previous step. At the conclusion of rating reasons, each solution alternative is re-rated on the scale of support, and should reflect the acquisition of pooled information about the alternatives.

Step 5B. Based upon re-rated alternative solutions, updated measures of separation among group members are displayed. At this point partial information biases and conversational biases within the group have been avoided. Differences between group members on alternatives should reflect more substantive differences of opinion.

Output from Step 5B becomes a critical input for the process which the model then initiates. The system calculates pairwise combinations of members who are furthest apart on

solution alternative ratings, and sets up a directed dialectic between these pairs. For example, finance may rate investment in new lab equipment on the lowest level of the solution support scale, while R&D rated it at the highest level. This difference between the two members is greater than any distance between finance and any other member/solution; thus the system automatically sets up a dialectic between finance and R&D. At the same time, however, a pairwise difference between R&D and sales may be greater than the difference between sales and any other member; so R&D may find itself in a dialectic with more than one other member.

The number of possible pairwise combinations grows very quickly with an increase in group size. Therefore, the system will have some form of flow control which limits the number of dialectics any member is directed to participate in. If prevented from establishing a dialectic between two members due to flow control, the system would search for the next greatest difference between the excluded member and another member.

Step 6A. At this stage the process of causal "mapping" is used (Huff, 1990). While some programs suggest using object oriented programming and graphic interface tools to facilitate this mapping, this process instead uses conversational mapping (Fiol, 1991).

Each member's screen displays the solution/reason hierarchy which was identified in Step 5B as being most disparate from another member. The member is asked to comment on the underlying reasons for the importance ratings s/he attached to the reasons displayed. Comments should be limited to perhaps 5 lines maximum for each reason. After finishing the commentary, the system automatically directs that commentary to the dialectically opposed member (Step 7A). The other member then has the opportunity to respond to the commentary provided for each reason. In the example, at the same time that finance is reading and responding to R&D's reason comments, R&D is reading and responding to finance's reason comments.

After responding to the comments of its dialectic partner, the responses are returned to the originating partner (Step 8A). As each member reviews the response to his/her reason comments, a window with automatic selection options appears and allows the member to

continue or discontinue the dialectic process for each reason. Selection options presented include:

1 No change in rating of reason. Provide further comment back to responder.

2 Change importance rating of reason to _____ . Provide further comment back to responder.

3 No change in rating of reason. No further comment.

4 Eliminate reason.

As long as option 1 or 2 is selected for any reason supporting a solution, the dialectic between members continues and the system iterates between Steps 7A and 8A. Once option 3 or 4 is selected for all reasons, the iterative dialectic process is terminated.

The point of uncovering fundamental thinking behind reasoning ratings is to discover causal logic and potential common ground for disparate members. The reason offered by finance for dropping extra funds to the bottom line, for example, might be greater profitability and higher stock price. Commentary on these reasons by finance reveals that the company needs to manage to a higher market appraisal of stock due to an impending need to raise additional capital through a stock offering. At the same time, exploring the reasons behind R&D's request for new equipment uncovers a common interest. R&D wishes to speed up the process of new product development by having greater testing capability. They believe that faster new product development capability means greater responsiveness to the market, and thus a higher appraisal of the company by analysts and the stock market. A common foundation has been derived by exploring the causal connections behind solution alternatives and surfaced reasons offered for those alternatives.

Step 8B. Once the dialectic processes between pairs of members has ceased, the system then displays the revised list of alternatives/reasons. Between steps 4B and 8B some reasons will have been dropped from consideration, and many will have changed in their importance ratings.

Step 9A. Similar to Step 5A, members are once again asked to review the list of solution alternatives with the revised hierarchy or reasons attached to each. This time, however, the system displays in a parallel window on their screens the list of evaluation categories agreed upon in Step 1B. Members are asked to consider the revised list of solutions/reasons in the context of evaluation categories, and to rank the alternatives based upon fit with the categories.

Step 9B. After ranking, the system displays the results to all members. At this point the decision rule criteria may determine that a consensus has been achieved. If not, the system automatically iterates back to Step 6A, and new dialectics are set up between disparate members based upon Step 9B results. The process continues to iterate until the decision rule is met.

Implications for Strategic Management Research and Practice

This paper has provided a brief review of perspectives from social psychology which inform group decision making processes, and has proposed a GDSS model for strategic decision making which builds on these perspectives. Instead of bowing to somewhat conventional academic practice of outlining specific testable hypotheses, an overall GDSS model design has been advanced and described. The model may be disaggregated into a series of hypotheses, and the overall model as a decision system might also be viewed as hypothesis.

Just as the proposed GDSS model is a proxy for testable hypotheses, it is also a proxy for effective strategic decision making process. As mentioned at the outset, the use of GDSS presumes that management seeks assistance in performing group decision activities. Thus, while the proposed model suggests theoretical foundation for the design of GDSS programs, it also highlights ways in which strategic decision processes might improve without the use of such programs.

The collectivity and cooperation necessary to effectively manage strategy (Mintzberg, 1987) places critical importance on the processes through which organizational members interact. Processes within top management teams are a core concern for those interested in

effective strategy (Hambrick, 1989; Summer, et al., 1990). In fact, Hambrick (1994) has called attention to the need to better understand behavioral integration of top management group members, including the quality and quantity of information exchange among them. The way in which top managers interact to arrive at shared understandings which bring out meaning, purpose, and direction for the entire organization (Daft & Weick, 1984) characterizes the essence of strategy process. While strategy researchers and practitioners may have concentrated heavily on strategy content such as that offered by Porter (1985), the processes through which strategy is conceptualized, agreed to, managed, and revised is equally important (Chakravarthy & Doz, 1992; Huff & Reger, 1987), and has received greater attention more recently. The link between strategy content and strategy process is viewed as inseparable (Pettigrew, 1992). In this regard many domains of research within the field of strategy are now focusing on the importance of processes within top management teams. These domains include strategic renewal, resource based theory, and strategic groups.

Strategic renewal research places importance on processes which facilitate the collection and integration of multiple perspectives by top managers. By many accounts the ability to achieve successful renewal hinges on the differentiation and integration of multiple perspectives about changing environments (Gersick, 1991; Quinn & Cameron, 1988). Processes through which top managers interact may or may not enable individual and multiple perspectives to be fed into strategic issue diagnosis (Dutton & Duncan, 1987). The ways in which top managers interact is a critical dimension determining whether strategic renewal efforts are successful (Hurst, Rush & White, 1989; West, 1995).

Examples in industry of firms undergoing dramatic renewal underscore the importance of the process through which top management teams must have achieved substantive interaction or not. For instance, what process loss must have occurred within IBM over several years such that the company drifted further and further from the realities of their markets? The strength of agenda effects, political influence, and poor sharing of new and contradictory information within

the executive group of the organization prompted a prolonged decline in market value and competitiveness for the firm.

For managers these perspectives are suggestive of new ways to consider sources of strategic change and renewal. First, changes in organizational communication systems and processes should parallel changes in organization structure. As organizations increasingly move away from hierarchical organization and its commensurate lines of reporting and information exchange toward flatter horizontal forms in order to become more responsive to dynamic markets (Daft & Lewin, 1993; Lewin & Stephens, 1993), revised organization communications dynamics become the glue that binds a flatter organization together. The substantive nature of exchange among members is changed in horizontal organizations; both formal and informal communication systems must be designed and implemented alongside changes in structural reporting relationships. Otherwise, functional or operating managers may become more isolated, and find it ever more difficult to transfer critical new perspectives and information to the rest of the organization.

This suggests, secondly, that management needs to consider communications beyond those which are offered through formal mechanisms of organization structure and traditional processes. The essence of horizontal organizations is structure with fewer formal channels and reporting relationships. This type of structure implies autonomy and self-direction on the part of discrete organizational subunits. Electronic systems and accessible databases may facilitate connections among now-removed, independent subunit managers. But management must also create opportunities for face-to-face communications, where substantive discussion, dialogue, and refinement of ideas and newly-acquired information may lead to new organizational knowledge and to the subsequent diffusion of such knowledge throughout the firm (West, 1995). Simply designating cross-functional teams may be insufficient for addressing changing dynamics effectively; management should also think through other formal and informal ways in which such team members may communicate with each other regularly and substantively.

In order to understand better how to design communication systems, both managers and researchers need to better understand conditions under which change ideas are dismissed or repressed. For example, the strategic planning exercise performed annually by many companies is a directed form of communication, where guidelines and adherence to a strict timetable allow restricted occasion for creative thinking. Where positive strategic change depends on a continual flow of ideas and reciprocal and refining exchanges among top managers (West, 1995), the annual planning process does not serve this purpose. The design of communication systems which produce both ideation and organizational guidance thus remains a key challenge for both managers and researchers.

Two aspects of the resource based view of the firm (Barney, 1991; Wernerfelt, 1984) also point to a critical dependence on the process through which managers interact. Resource content (Schulze, 1994) focuses on characteristics of resources such as their value, imitability, and tradability. Such resources are to be discovered within the firm, and discovery relies upon managerial interpretation (Barney, 1991). Dynamic capabilities is the process form and focuses upon the processes through which firms identify such resources. Teece, Pisano, and Shuen (1992) describe the combinative capabilities of firms as being the critical level of analysis. The effectiveness of this process depends on information sharing. Thus, competitive advantage is seen as arising to the extent that managers create higher order organizing principles which effectively orchestrate the sharing and communication of information and knowledge (Grant, 1993; Kogut & Zander, 1992). For both forms of theory, then, crucial importance is placed upon the managerial processes through which resources are identified and elevated to strategic importance considered by top management (i.e. placed on "the agenda"). For example, Seagate Technology has prospered in a time of trouble for hard disk manufacturers, largely as a result of top management's ability to identify a core set of skills and apply them across multiple products (Economist, 1993).

Strategic group research now reflects the importance of top management group processes. Research has typically focused on strategic content and strategic investments as defining

strategic group membership. However, Reger and Huff (1993) find that one appropriate means for identifying groups may be through the mental models of the industry created and shared among the firm's managers. Thus characterizations of groups may rely less on the rational description of strategic types and aggregated strategy variables, as on the cognitive processes of interpreting industry information and the organizational processes through which such images and interpretations become shared (Daft & Lengel, 1984). Porter (1985) suggests as much when he emphasizes the importance of defining industry boundaries. In turn, the utility of strategic group analysis informs management as to strategic actions. Thus Cool and Schendel (1988) find that the value of such analysis is in management's ability to assess weak and missing competences, and to therefore adjust asset bases.

The appropriate design of GDSS may thus improve top management group processes, and have far-reaching consequences for firms in these and other theoretical domains of strategy. Strategic renewal efforts may be enhanced through GDSS which enables new information about changing environments to be considered at an earlier date by top management. Similarly, inertial properties of firms, as evidenced through agenda and power influences on strategic discussions, may be overcome by GDSS which promotes equality of viewpoint and which aims at underlying causal notions. GDSS may also enable the identification by top management of new and emerging resources and capabilities, leading to sustainable competitive advantage.

The GDSS model proposed in this paper has implications for strategy and GDSS researchers. For GDSS researchers this model affords the opportunity to test group process theory against more technically-oriented GDSS designs. Improved decisions and decision process outcomes which are evident using this model may inform enhancement to other, more technically proficient models. Incorporating technical proficiency and theory-based "process gain" designs would result in much improved models for practitioners to use.

For strategy researchers the proposed model represents a unique means to study process effects in top management teams. The model might also be used to help define resources, capabilities, and competences as firms see them, and to understand how much variance exists

within firms on such definitions. Finally, the sophisticated means of generating reason hierarchies and ratings for solutions would also provide a new way to marry quantitative analysis with causal mapping.

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FIGURE 1
Model of Strategic Management GDSS