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Challenging Group Support Systems Research: The Case for Strategic Decision Making

EDWARD W. CHRISTENSEN
School of Business Administration, Monmouth University, West Long Branch, New Jersey 07764

JERRY FJERMESTAD
School of Industrial Management, New Jersey Institute of Technology, Newark, New Jersey 07102

Abstract

Strategic decision making (SDM) often occurs in groups that can benefit from the use of group support systems (GSS). However, no comprehensive review of this logical intersection has been made. We explore this intersection by viewing GSS research through the lens of SDM. First, SDM is broadly characterized and a model of GSS-mediated SDM is produced. Second, we review empirical GSS research linking these findings to the characteristics of SDM. We conclude that GSS research has not produced sufficient knowledge about group history, heterogeneity, member experience, task type, time pressure, technology or tool effects, and decision consensus for a favorable evaluation of SDM in GSS groups. SDM in GSS groups challenges researchers to study the effects of group processes such as those just mentioned in a context that involves ongoing and established groups, political activity, and a multiplicity of tasks.

Key words: Group support systems, group decision making, strategic decision making

1. Introduction

The integration of information technology (IT) into organizations continues at a staggering pace, and executives and managers increasingly are concerned with the uses of IT for strategic planning and competitive advantage (see, e.g., Mockler and Dologite 1991). However, the use of IT in strategy formulation often is relegated the mundane information acquisition activities reminiscent of the largely defunct data processing department. The literature on decision support systems, executive information systems, computer-mediated communication, and group support systems directly show how IT augments executive and managerial activities. One such activity, strategic decision making (SDM), is addressed by the decision support and executive information system literature. But strategic decision making is not solely individual; rather, it takes place on behalf of an organization and among a management team (Murray 1989; Brodwin and Bourgeois 1984). Therefore, an exploration of group support system (GSS) utility in SDM is warranted.

Our presupposition is that GSS and our knowledge about them are at a developmental stage when it is appropriate to explore their role in SDM. However, because items in the literature have not been systematically related, it is unclear in what ways GSS can improve SDM. The purpose of the paper is this integration that challenges existing GSS research knowledge. To illuminate their intersection we review a set of general SDM characteristics and relate these to current GSS knowledge.[1] Then, we suggest that SDM studies of GSS groups can not only bridge the gap between these items of literature but can further GSS and SDM knowledge by complementing the strengths and weaknesses of each.

2. Strategic decision making

Within the strategy discourse, a distinction is drawn between the strategic process (formulation and implementation) and the content of a strategy. The focus of this paper is on the SDM *process* of strategy formulation, because the GSS domain encompasses general decision-making processes and not the content or implementation of a decision. This task is made more difficult because of a bias toward content in the strategy literature (Rajagopalan, Rasheed, and Datta 1993). Other views of SDM follow the traditional decision-making models of rational or bounded rationality, political, and "garbage can" processes (e.g., Eisenhardt and Zabaracki 1992; Schwenk 1988). We have chosen an alternative view by considering many components these decision-making models allowing SDM to take any of these forms.

Rajagopalan et al. (1993) summarize SDM in terms of six major components: environmental factors, organizational factors, decision factors, process factors, process outcomes, and economic outcomes. Because the logical endpoint of a GSS is a decision or solution, the first five components are germane here. Figure 1 illustrates GSS-mediated decision making in which environmental, organizational, group, and decision-specific factors are key influences in the SDM process and that the process is mediated by GSS through the application of various tools and structures. For clarity, group factors are separated from organizational factors. Although this model allows for both individual and group decision-making processes along with their respective support technologies (DSS/EIS and GSS), the former are not reviewed. Instead, we limit our discussion to groups because often groups address strategic problems and decisions (Brodwin and Bourgeois 1984) and SDM requires interaction among managers in sharing and assessing information, recommendations, and beliefs (Daft, Bettenhausen, and Tyler 1993). Therefore, we foresee the potential of GSS for SDM.

The process by which a strategy is formulated is through a stream of strategic decisions that form a pattern giving meaning and direction for the organization (Mintzberg 1990). Several key points must be considered when studying SDM. First, decisions are undertaken within an organizational context and the subgroup of management charged with strategy formulation and implementation. Second, the boundary between the organization and its environment necessitates that the organization understand its environment if it is to survive and be successful. Strategy is the process by which decisions about how to negotiate exchanges with the environment. Therefore, it follows that SDM involves environmental, organizational, group, and decision factors associated with the decision process and outcome. These factors further suggest that a strategic decisions are often

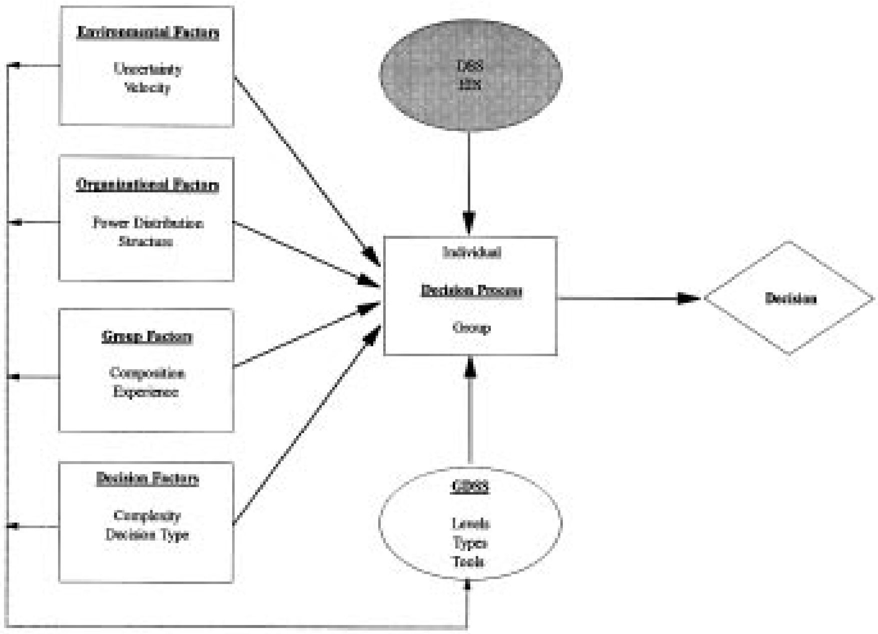

Figure 1. Computer-supported group strategic decision making (adapted from Rajagopalan, Rasheed, and Datta 1993).

ill-structured, novel, and consequential (Mintzberg, Raisinghini, and Theoret 1976). Because our intent is to intersect the GSS and SDM literatures from the perspective of GSS, we have opted to summarize SDM broadly in terms of these components.

2.1. Environmental factors

Studies of environmental factors and SDM place environmental uncertainty central to SDM. For example, Fredrickson and his colleagues consistently have found a positive relationship between environmental instability and decision comprehensiveness—the extent to which a decision process attempts to be exhaustive (Fredrickson 1984; Fredrickson and Iaquinto 1989; Fredrickson and Mitchell 1984). Eisenhardt's research in "high velocity" environments further finds that decision processes are more comprehensive but only over a short period (Eisenhardt 1989; Bourgeois and Eisenhardt 1988). Hence, two environmental factors in SDM, uncertainty (instability) and velocity (rate of change), are associated with decision comprehensiveness.

In related literature with an information processing focus, environmental factors also play a key role. Here, an organization processes information to reduce uncertainty—the difference between the information required to complete a task and the amount already possessed—and equivocality—the existence of multiple and conflicting interpretations

(Daft and Weick 1984). For example, Daft, Lengel, and Trevino (1987) found that, when perceived strategic uncertainty is high, CEOs reported more frequent use of a wider range of scanning (information gathering) modes (see also Daft et al. 1993). Also, Galbraith (1977) proposes several structural mechanisms for the reduction of uncertainty by reducing information need or increasing processing capacity. The latter, he suggests, can be accomplished through vertical information systems and lateral relations. Organizations facing uncertain environments require greater information processing, which takes the form of increased environmental (context) scanning, use of information systems, and liaison roles (e.g., direct contact, teams) by organization members. If these strategies are successful, day-to-day decision making takes place within the "certainty" produced by a strategy, although strategic decision makers remain exposed to environmental uncertainties. In summary, SDM is influenced by environmental uncertainty (instability) and velocity. Specifically, uncertainty is positively related to decision comprehensiveness and information processing demands; the former is moderated by velocity of environmental change.

2.2. Organizational factors

Formal structure and power centralization also are important factors in SDM. Several studies report that power centralization and formal structure are positively associated with rational decision making and decreased political activity (Shrivastava and Grant 1985; Miller 1987; Miller, Droge, and Toulouse 1988). According to Bourgeois and Eisenhardt (1988) power centralization in quickly changing environments is aligned with nonrational decision processes and increased political activity. It is possible that these differences are due to environmental characteristics (i.e., velocity), yet no studies report on this proposition. In summary, organizational structure and power distributions are positively related to political activity and perhaps moderated by environmental change velocity.

2.3. Group factors

In general, heterogeneous groups outperform homogenous groups on creative tasks but in intellective and execution tasks the evidence is equivocal (Jackson 1992). The simple reason for this performance difference in creative tasks is that heterogeneous group members bring different perspectives to the group, and for tasks where number and breadth of alternatives is important these differences are beneficial. This general finding is counterbalanced with evidence of process losses in heterogeneous groups borne from an increased interpersonal and role conflict (Mason and Mitroff 1981). For these reasons, Stein (1981) proposes stark differences in strategic decision processes along the dimension of group heterogeneity.

Group cohesiveness also is important in group decision making because cohesive groups outperform noncohesive ones (Jackson 1992; McGrath 1984). *Cohesiveness* refers to the degree to which members are motivated to stay in a group and is negatively related to group heterogeneity (Shaw 1976). Similarly, consensus in SDM groups has been systematically related to corporate performance although with significant variance (Dess and Origer 1987; Priem 1990). Intragroup conflict reduces the possibility of consensus and in turn decreases the performance impact of SDM. Thus, heterogeneity is positively associated with creativity in groups but negatively associated with intragroup conflict. One can surmise that, if consensus is reduced due to intragroup conflict, this may further decrease performance. Studies of SDM group characteristics such as age, personality and expertise may explain differences in decision processes but they have seldom been done (Rajagopalan et al. 1993).

2.4. Decision factors

It is difficult to pinpoint consistent findings in the research on SDM processes. However, this suggests that strategic decisions are complex, critical to organizational function, and occur relatively infrequently, in a complex, political process (Fahey 1981; Cray et al. 1991; Schilit and Paine 1987). For example, in a field study of SDM, Shrivastava and Grant (1985) found four "prototypical" SDM models: managerial autocracy, systemic bureaucracy, adaptive planning, and political expediency. Of these, the last three are group processes varying partly on the degree of political activity. Also Mintzberg, Raisinghini, and Theoret (1976) clearly demonstrate the complexity of SDM in their field study of 25 organizational decisions. Complexity of decisions is associated with increased information processing needs and slower decisions. Likewise, political activity and conflict increase the decision time through an increased need for conflict management.

2.5. Summary of strategic decision making

The SDM literature suggests that environmental uncertainties will lead to greater information-processing demands and comprehensiveness, and this relationship is moderated by the velocity of environmental change. Decision complexity is positively associated with comprehensiveness, and comprehensiveness leads to increased time to make a decision. Power distributions in existing organizational roles will result in increased political activity as well as role and interpersonal conflict. And group heterogeneity is positively associated with the amount of information exchange and diversity of perspectives, which lead to increased creativity. Heterogeneity also is negatively related to group cohesiveness, an increased likelihood of intragroup conflict, and decreased consensus. It is important to note that most SDM studies are survey or questionairre designs that contrast with the experimental designs of GSS studies.

Mason and Mitroff (1981) perceptively summarized that strategic decisions (a) have numerous and complex link among organizational and environmental variables, (b) take place in uncertain and dynamic environments, (c) require the resolution of ambiguity in information and their sources, (d) are constrained by incompleteness in available information, and (e) exhibit conflict about decision outcomes among interested parties. In reviewing SDM, we have emphasized factors that are relevant to group decision making. These components constitute a lens through which the intersection of SDM and GSS can be examined.

3. Gaps in computer-supported group strategic decision making

A search of the GSS literature yielded 64 articles satisfying the criteria of an *empirical* study in *group support systems* such as group decision support systems (GDSS), electronic meeting systems (EMS), and computer-mediated communication (CMC). The idea was to capture as many studies as possible that pertained to the software and hardware class termed *groupware* (Grudin 1994). The breadth of the initial search was limited to publications in which GSS studies were likely to be found, such as conference proceedings (e.g., Hawaii International Conference of Systems Science), *Journal of Management Information Systems, Journal of Organizational Computing, MIS Quarterly, Group Decision and Negotiation, Decision Support Systems, Information Systems Research*, and *Small Group Research*. Additional studies from other sources were added in a networking fashion based on the citations found in the original set. Articles that report results from multiple studies (e.g., several data sets) were separately coded, as well as multiple articles from the same study.[2] The initial coding was done by the second author and random set of these were coded by the first author for reliability (average test-retest = .97 across all coded variables). Disagreements were resolved through discussion and re-evaluation. The years of publication ranged from 1970 to 1994 with the majority (86%) published after 1990. The categories selected for review are those commonly reported in these studies and informative to SDM (Fjermestad, Hiltz, and Turoff 1993). The categories are group history, group composition, task type, technology type, and process and outcome measures. Where possible, links to similar concepts in SDM (section 2) are made.

3.1. Group history

As noted previously, several areas of GSS study are informative to SDM. The first, group history, divides studies into those using ad hoc and established groups. Group history is a subset of group factors in SDM. Studies of ad hoc groups comprised 86.5% with only three (4.1%) reporting results of established groups (Dennis et al. 1990a; Hiltz, Johnson, and Turoff 1991; Hiltz, Turoff, and Johnson 1989). SDM often takes place in groups with individuals who have a working history in that group. The effects of pre-existing relationships and identification with other social groupings is not well addressed by GSS studies. This is important because conflict and decision quality are moderated by group history, in that decision quality is positively related to conflict in established groups, but this relationship is reversed in ad hoc groups (Hall and Williams 1966). Although Benbasat and Lim's (1993) meta-analysis found that group history was not significantly related to decision quality and negatively affected the equality of participation, this was found among nonorganizational groups. The primary reason for the lack of study on established groups is that these studies sought to explain differences between GSS and non-GSS groups (Dennis et al. 1988). In general then, GSS knowledge applied to SDM should be done with the knowledge that the group history effects of GSS groups is not well understood, and given the differences in traditional groups, it is reasonable to assume that differences may exists in GSS groups as well.

3.2. Group composition

Related to organizational and group factors in SDM are issues of group composition such as heterogeneity and experience. Heterogeneity in group composition is a mixed blessing, because although it is associated with greater divergence of ideas, it also increases the likelihood and amount of interpersonal conflict, requiring more conflict resolution. In SDM, often there is heterogeneity of experience and background that may result in both gains and losses. The GSS literature contains very few studies of group heterogeneity. Studies that report on the effects of heterogeneity mostly are electronic brainstorming studies, which find that GSS groups outperform traditional face-to-face groups because of equalization in participation and decreased dominance by any single member (Valacich et al. 1993). SDM is a political, conflict-ridden process that is in part due to heterogeneity, yet little evidence suggests that this is ameliorated in GSS groups other than those whose task is creative.

A methodological concern arises from the predominance of student subjects (84% of the studies), in that they are not representative of SDM groups. For example, differences in age, experience, and professional knowledge may not produce equal effects between these students and strategic decision makers. Experimental studies have advanced our knowledge of GSS groups appropriate for early knowledge development but this knowledge may not generalize to SDM, where the range of tasks and differences in experience are well beyond present understanding. In summary, group heterogeneity has not been adequately studied and research has been done primarily using students as subjects.

3.3. Task types

Decision factors in SDM are closely linked to task types. Furthermore, SDM is a type of decision making that has different levels (strategic, tactical, and operational) that are composed of subtasks generally studied by GSS researchers. For example, a tactical decisions may be composed of a series of judgment and choice activities.

The GSS literature has adopted McGrath's (1984) task typology, which separates tasks along cognitive/behavioral and collaboration/conflict resolution dimensions. In this typology there are four general task types: generate tasks (creativity and planning), choice tasks (intellective and decision making), negotiation tasks (cognitive conflict and mixed motive), and execute tasks (psychomotor and competitive). The majority of GSS studies employ creative tasks (55.4%), measuring creativity and alternative generation of GSS and non-GSS groups (see table 1). It is notable that none of the studies employs planning

Table 1. Task types studied in GSS

Task Category	Task Type	Studies
Generate	Creative	1, 3, 7, 8, 9, 10, 11, 12, 13, 14, 15, 23, 24*, 27, 28, 30, 31A, 32, 33, 34, 35, 37, 38, 39, 40, 42, 43, 44, 47, 49, 51, 52, 53, 58, 59, 62, 66, 67
Choice	Intellective	2, 21
	Decision Making	4, 5†, 6, 20, 21, 22*, 25, 26, 29, 36, 41, 45, 46, 48, 50, 60, 61, 64
Negotiation	Cognitive Conflict	16, 17, 54, 56, 57, 63
	Mixed Motive	67

Note: See the References for study number.
*More than one data set is reported.
†The same data set has been used in more than one study.

tasks, another subset of generation tasks and a common strategic activity (Anthony 1965). More than one-quarter of the studies report results from intellective and decision-making tasks that require judgment of alternatives and choice among those alternatives. Intellective tasks are not of great import in SDM, because these tasks have a correct answer, an unlikely condition in SDM. Decision-making tasks, on the other hand, require judgment and choice among a set of alternatives, and some studies have used decision-making tasks that are strategic in nature (Burke and Chidambaram 1995; Miranda and Bostrom 1993). For example, the Palo Verde Vintner, Inc., case requires subjects to generate plausible solutions (generation) to a strategic task and then select a solution (choice) in areas such as marketing, international product development, quality, and finance (Chidambaram, Bostrom, and Wynne 1990). SDM often includes conflict and other political activity, yet less than 10% of the tasks studied employed negotiation tasks. In addition, the study of single-task groups severely limits our ability to describe or predict the feasibility of computer support for group SDM. A notable exception of the single-task group is the JEMCO Workshop, a study of ongoing groups involving 13 different tasks, including several experimental manipulations such as changes in media and membership (McGrath 1993). Generally, findings based on single-task studies and nonrepresentative strategic tasks make the logical extension of GSS knowledge to SDM difficult.

With respect to task complexity, GSS groups display improved decision quality over non-GSS groups on simple tasks. GSS groups also display decreased time to reach a decision over non-GSS groups in complex tasks and the opposite in simple tasks (Benbasat and Lim 1993; McLeod and Liker 1992). This represents an important trade-off between quality and time to reach a decision. On the one hand, GSS groups produce a higher-quality decision than non-GSS groups but at the cost of time, especially in simple tasks. On the other hand, the time to reach a decision is decreased in complex tasks but quality suffers. Given that SDM is both time sensitive and complex, it is unwise to suggest that GSS groups will outperform non-GSS groups in terms of quality. However, if time is of the essence, as suggested by SDM studies, then perhaps GSS have an advantage.

3.4. Technology types

Group support technologies and tools structure the group process (Steiner 1972). In SDM a GSS mediates this process. For example, an outlining tool provides task structure and an agenda process structure. Therefore, the effects of different technologies applied to different tasks are at the core of GSS research that one should be able to apply to the SDM process.

Several frameworks are used to divide GSS technologies. One framework is by the GDSS level (DeSanctis and Gallupe 1987), and another is to categorize them by system type (DSS, GDSS, CMC, etc.). DeSanctis and Gallupe's levels model proposes that technologies be categorized by features such as communication and decision support. A Level 1 GSS provides only communication support (e.g., e-mail, CMC), and a Level 2 GSS also includes decision support. Thus, a Level 1 GSS facilitates the exchange of information on both task and social dimensions, and a Level 2 GSS also includes specific task supports. In a comparison of differences between Level 1 and 2 systems, Sambamurthy, DeSanctis, and Poole (1995) found that groups using the more complex system (Level 2) had more conflict and higher conflict management success, which in turn led to increased consensus. This finding generally supports the contention that the more-complex Level 2 GSS provide both task and process support necessary in SDM, yet comparisons of GSS level constitute less than 7% of the studies (see table 2). Similarly, studies of computer-mediated communication are directed at group process (Kiesler and Sproull 1992) whereas other GSS studies are directed at task outcome.

Table 2. Technology types

	Studies		Studies		Studies
Levels					
Level 1	1, 2, 3, 4, 7, 8, 9, 10, 13, 14, 16, 19, 21, 23, 24*, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 38, 39, 40, 42, 44, 50, 51, 52, 53, 56, 57, 58, 59, 61, 64, 65, 66	Level 2	5†, 6, 11, 12, 20, 22*, 36, 41, 43, 45, 47, 49, 50, 54, 55, 60, 63, 67	Level 1 vs. Level 2	15, 17, 18, 37, 48
Types					
CMC	1, 13, 14, 19, 20, 21, 31, 32, 33, 35, 51, 52, 53, 57, 58, 59, 61	GSS	2, 3, 4, 5†, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 18, 22*, 23, 24*, 25, 26, 27, 28, 29, 30, 34, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 54, 55, 56, 62, 63, 64, 65, 66, 67	DSS	50, 60

Note: See the References for study numbers.
*More than one data set is reported.
†The same data set has been used in more than one study.

SDM is characterized by multiple, ongoing tasks including generation, choice, and negotiation that require a range of tools concomitant with those tasks. As is evident from table 3 the plethora of tools used in these studies increases the complexity of conclusions one can draw about each technology or tool. To our knowledge, a systematic comparison of tools has not been done. Given that a tool framework is lacking, we are forced to generalize into broad categories. Table 3 provides an outline of tool and tool category for the studies reviewed. Our choice of categories is functional, inductive, and simple, yet it demonstrates that, with the exception of communication and structuring tools, most tools are directed at improvements in the task and not the process. Process studies, however, increasingly are being undertaken, such as those involving dialectical inquiry and devil's advocacy (Valacich and Schwenk 1993a, 1993b). The use adaptive structuration (AST) by GSS researchers (Gopal, Bostrom, and Chin 1992; see also DeSanctis and Poole 1994) provide evidence that tools are not adopted faithfully, nor are the task and the process independent. That is, a tool may be unfaithfully adopted producing an undesired effect at the task level, process level, or both.

Table 3. GSS tools

Tool Category	Tool	Study
Group Memory	Lists	12, 14, 20, 42, 58, 59
	Share Editor	35, 46
	Hypercard	44
Priority Setting	Ranking	12, 22*, 25, 26, 32, 36, 49†, 63, 65, 66
	Cue Weights	50
Choice	Voting	5†, 6, 8, 12, 14, 20, 22*, 25, 27, 28, 58, 59, 63, 64, 65, 66
	Multiple Criteria Decision Making	2, 3
Idea Generating	Electronic Brainstorming System	5†, 6, 7, 8, 9, 10, 15, 22*, 23, 24*, 25, 28, 38, 39, 40, 56, 63
Inquiry	Issue Analyzer	5†, 18, 28
	Stakeholder Identification and Assumption Surfacing	16, 17
	Interactive Stakeholder Identification and Assumption Surfacing	17
	Question	20
	Strategic Assumption Surfacing and Testing	48
Process Structuring	Nominal Group Technique	41
	More (outlining system)	44
Communication	Electronic Discussion System	6, 15, 27, 64
Analysis	Simulation	67
	Cross Impact	41
	Policy	40

Note: See the References for study numbers.
*More than one data set is reported.
†The same data set has been used in more than one study.

GSS studies of technological differences and tool differences do not follow a systematic framework that allows cross-study and technology comparisons. Moreover, these technologies and tools affect the group at both the task and process levels. Knowledge of this interaction and the effects of task and process gains and losses has not been systematically generated because of a lack of a common conceptual framework or agreement on tool categories. It is not possible, then, to clearly link GSS levels or tool types except with broad generalizations to group outcomes (section 3.3) from studies of nonrepresentative SDM tasks.

3.5. Group process and outcome measures

Many GSS studies report a measure of some group outcome or process such as consensus, satisfaction, conflict, or decision quality. Details of which studies report what outcome and process measures are presented in table 4. These are similar to the decision outcomes studied in the SDM literature. Most GSS studies emphasize satisfaction (44.5%) and decision quality (48.6%) as measures of group outcome. The primary reason for these measures is that the studies investigate differences in technology use (i.e., GSS vs. non-GSS). In group SDM, a process measure salient to performance is group consensus (Dess and Origer 1987). Our review includes only 13 studies that report decision consensus. These suggest that consensus is *not* improved by a GSS. Evidence for increased, unchanged, and decreased consensus can be found with most reporting negative or no effect. For example, George et al. (1990) found that GDSS groups were less likely to reach consensus than face-to-face groups (see also Hiltz, Johnson, and Turoff 1986; Ho and Raman, 1991; Watson, DeSanctis, and Poole 1988). Other studies have found no effect (Dubrovsky, Kiesler, and Sethna 1991; Gallupe and McKeen 1990; Hiltz et al. 1989; Valacich and Shwenk, 1993a, 1993b). Sambamurthy et al. (1995) found that change in consensus between premeeting and postmeeting measures was related to the GDSS level, further complicating the interpretation of consensus findings.

Although it is unclear whether cohesion improves performance, success strengthens cohesion, or both, cohesiveness is related to performance. Highly cohesive groups show increased conformity (O'Reilly and Caldwell 1985), which may be helpful when deviance endangers the group and harmful when innovation and creativity are necessary (Janis 1982). Of the studies reviewed, only three report measures of cohesiveness with mixed results. For example, Chidambaram et al. (1990) found that cohesiveness was initially higher in face-to-face groups but there was a gradual reversal as the groups continued to meet. In sum, little evidence supports the proposition that consensus and cohesiveness, which are positively related to group performance, are enhanced by GSS.

The strategy literature is replete with references to rapid and unpredictable change in environments and customers that demand faster and better actions on the part of the organizations (Eisenhardt 1989; Fredrickson and Mitchell 1984). The time needed to make a decision is an important factor in organizational success. As is evident from table 4, GSS groups take longer to arrive at a decision than their face-to-face counter parts (Benbasat and Lim 1993). For example, Gallupe and McKeen (1990) found that GSS

Table 4. Outcome and process measures

Measure	Studies	Measure	Studies
Efficiency			
Decision Time	2, 11, 13, 16, 17, 28, 36, 50, 51, 54	Number of Rounds	49†, 58
Decision Speed	3, 9, 26	Time Discussing	21, 59
Iteration Time	49	Days Worked	20, 21
Depth of Analysis	2, 7, 13, 16, 17, 19, 23, 24, 25, 28, 31, 35, 37, 38, 46, 50, 51, 52, 57, 58, 66		
Satisfaction			
General Satisfaction	2, 3, 7, 9, 10, 14, 15, 19, 22, 23, 24†, 25, 26, 27, 28, 32, 37, 39, 41, 48, 56, 64	Decision Satisfaction	1, 16, 17, 47, 54, 55, 58, 63, 67
Process Satisfaction	16, 17, 46, 54, 55, 58, 63		
Conflict			
Conflict	25, 45	Direct/Indirect Conflict	8
Managed Conflict	5	Cohesiveness	4, 5†
Consensus			
Consensus	1, 11, 12, 15, 25, 27, 28, 31*, 32, 34, 43, 48, 62	Compromise	36
Consensus Change	47		
Decision Quality			
Decision Quality	1, 4, 5†, 6, 7, 8, 10, 15, 16, 17, 18, 19, 21, 22*, 25, 26, 27, 28, 29, 31*, 32, 37, 40, 44, 46, 48, 54, 55, 56, 57, 58, 59, 60, 63, 64, 67	Number of Alternatives	5†, 6, 13, 15, 16, 17, 25, 27, 28, 38, 39, 41, 50, 51, 57, 58, 59
Depth of Evaluation	20, 48, 54, 55	Number of Ideas	7, 9, 10, 23, 24*, 29, 35, 54, 56
Length	46, 54	Deviation/Correctness	52, 53, 2
Decision Confidence			
Decision Confidence	22*, 23, 25, 26, 36, 48, 50	Acceptance	20, 41

Note: See the References for the study numbers.
*More than one data set is reported.
†The same data set has been used in more than one study.

groups took longer to arrive at a decision and dispersed groups took longer than proximate groups. They also found that GSS groups had higher decision quality than traditional face-to-face groups. This generalized increase in decision quality is both encouraging and cause for skepticism. Decision quality in these studies is defined by experts, because generated tasks have correct answers and choice tasks have relatively better or worse answers. In the often ambiguous and ill-defined strategic decision, there is no benchmark from which to judge the quality of a decision except by its outcome.

Several studies report a measure of depth of analysis that is representative of comprehensiveness in SDM. For example, Jarvenpaa, Rao, and Huber (1988) found that face-to-face groups had the most thorough communication of two electronic conditions in an unstructured software design problem. Also, Smith and Vanecek (1988) found that face-to-face groups shared more information, eliminated poor alternatives more correctly, and examined more decision attributes than GSS groups on a complex intellective task. Consistent with the SDM literature, GSS studies find increased comprehensiveness (e.g., depth of analysis) in face-to-face groups. However, consensus in GSS groups is not increased beyond non-GSS groups and may even be reduced. One explanation for this result is that communication needs in resolving ambiguity may drive the group process in ambiguous tasks (Daft and Lengel 1984). It is extremely difficult to decipher the effect of depth of analysis from these studies and determine whether a decrease in depth of analysis results in poorer decisions. When depth of analysis is coupled with the need for faster decisions in rapidly changing environments and the general finding that GSS groups take longer to complete their task than face-to-face groups, a caveat to SDM in GSS groups is perceptible.

3.6. Summary of GSS and SDM

A practical evaluation of computer-supported SDM can be made by considering whether the use of a GSS for SDM provides better decision outcomes than those of non-GSS groups or produces similar outcomes with other benefits, such as reduced costs or time. With respect to performance, the results are equivocal. GSS groups take longer to reach decisions of higher quality and of greater creativity than non-GSS groups. Task complexity moderates decision quality and time to reach a decision, further compounding the practical use of GSS in SDM. However, a positive aspect to GSS is that GSS groups are able to work despite geographical dispersion and can do so asynchronously. In SDM this means that international and even domestic strategy formulation and decision making can be accomplished with less scheduling difficulties and transportation costs. The question remains whether conflict can be successfully managed and or averted by integrating GSS into SDM.

A theoretical evaluation requires the reconciliation of SDM and GSS knowledge. This evaluation is less optimistic because the variables and concepts in the two areas of the literature differ so greatly. A mapping of SDM factors and GSS research yields the pairings (SDM/GSS) of organizational factors/group composition, group factors/group history and group composition, decision factors/decision type, and process factors/process and outcome. The notable exception is that we find no pairing in the GSS research for environmental factors. If we compare our findings of GSS groups with the SDM literature along the lines of these dyads, several gaps appear in terms of: group history (section 3.1), group heterogeneity (section 3.2), subject experience (section 3.2), task types (section

3.3), time sensitivity (section 3.3), technology/tool effects (section 3.4), decision consensus (section 3.5), and time to reach a decision (section 3.5).

In general, the paucity of results about GSS group processes is alarming, even though the study of process in individual and group decision-making research provide frameworks to draw on. Although this most likely stems from the fact that GSS technologies and tools are designed to impose a process on groups, actual improvements depend on the faithful appropriation (e.g., actual use equals designed use) of that technology by the users (DeSanctis and Poole 1994). The number and nature of the gaps in our knowledge between GSS groups and SDM lead us to conclude that research opportunities exist in the intersection of this literature that have practical implication as well.

4. Research of strategic decision making in GSS groups

The majority of the studies reviewed in this paper were experiments in which comparisons between GSS and non-GSS, technologies or task type were made. The logical intersection of SDM and GSS results in new research opportunities. Our general conclusion is that research is required on ongoing groups, heterogeneous groups with the possibility of intragroup conflict (role and interpersonal conflict), completing multiple tasks, and under time pressure. In studying ongoing groups, the application of group development theories will provide insight into the interaction of groups and technology and the emergence of group structure (Chidambaram and Bostrom 1997). Studies of heterogeneous groups, especially with respect to role and interpersonal conflict, and the use of GSS in managing these conflicts, will produce GSS capable of enhancing group work in increasingly diverse organizations and teams. Groups seldom encounter single tasks, making it important that studies of ongoing groups with shifting tasks and feedback from past decisions be undertaken. Finally, time constraints and deadlines on groups are an understudied area in the group literature in general (McGrath 1988) and germane to SDM in GSS groups in particular. Although it is necessary to study each of these areas in isolation, we encourage a more holistic and systematic approach using SDM as a template. We propose that GSS studies of SDM provide incredible opportunities for new and innovative research that are of practical interest for managers and academic interest for researchers. These studies can be experiments, field studies, or any other form of scientific inquiry.

Although many of our concerns can be ameliorated by field studies, research designs such as the JEMCO Workshop (McGrath 1993) also are possible. This type of study has several benefits. First, it maintains a degree of control in highlighting particular facets of GSS groups. For example, we found little research that reported on conflict and conflict negotiation in GSS groups. Second, the SDM context would allow groups to work on a variety of tasks over time. Our knowledge of established and ongoing GSS groups is severely limited. Given that the use of technology by organizations surely will involve these types of groups, studies of this type are necessary.

One possible experimental design of this type could take place in a typical business policy or executive development course, where the study of SDM benefits researchers and students. Groups can be created in terms of their heterogeneity of background, experience, personality, and gender to study conflict and conflict management efficacy in the GSS environment. These groups could be given different strategic decisions using a variety of cases through the length of the course that would allow for the study of group development. Some of these decision can be given different deadlines, allowing for concurrent group tasks, resulting in information about time pressures. As a capstone course in most business schools, it is possible to apply analytical as well as behavioral knowledge. Conflict management techniques, leadership, group structure, and other behavioral concepts can be employed as manipulations that also serve as applied managerial knowledge.

These studies of SDM provide other challenges as well. Recall the scarcity of studies of SDM processes. Also, SDM studies typically have been questionairre or survey designs, with the notable exception of Fredrickson's (1986) study in which strategic decision scenarios were used. Studies of this type are needed because they afford benefits of laboratory control along with realism (Rajagopalan et al. 1993). Scenario-driven experiments are not uncommon in GSS research and complement SDM research.

Our exploration of the intersection of GSS and SDM has brought us full circle. Research on SDM in GSS groups provides a context in which to produce knowledge that furthers both areas of inquiry. For example, the study of SDM in GSS groups quite naturally leads to concerns about group heterogeneity that are important because of increasing workforce diversity and that are understudied in both fields. Our characterization of the current knowledge suggests that much of what is needed is the result of methodological choices. That is, this knowledge is based on experimental studies of ad hoc groups using relatively simple tasks with little interest in the GSS group process. Others have urged GSS researchers to move into the next generation of research, which involves more field experimentation and established groups (see, e.g., McGrath and Hollingshead 1994). However, opportunities exist for laboratory studies of SDM and associated processes (i.e., conflict, heterogeneity, etc.) that are not yet practical for field research.

One final possibility exists: SDM may be best when the best of GSS and traditional group decision-making formats are combined. That is, GSS is best suited for initial information gathering and idea generation across time and geographic boundaries, but a face-to-face group may be advantageous for decisions that remain complex, ill-defined, and require multiparty negotiation (Kiesler and Sproull 1992). In any case, the SDM context provides new opportunities for studying groups, especially GSS groups.

5. Conclusion

We have reviewed the GSS literature with respect to a set of general characteristics about SDM and found evidence for and against SDM by GSS groups. Gaps have been identified that require both empirical study and new theoretical approaches. McGrath and Hollingshead (1994) conclude that future group support systems research should be pursued in the areas of multiple criteria for assessment, member and group characteristics, task-technology variation, groups as multifunctional systems, and temporal dimensions of group work. Although we agree with these, we have taken the further step to suggest specific areas of inquiry and a type of decision making that can provide a context from which needed GSS knowledge can be generated. A major concern is that GSS research has not extended our knowledge of electronic group processes because of the methodological bias extant in technology comparisons. Research on GSS group process like DeSanctis and Poole's (1994) use of adaptive structuration theory are in line with traditional group studies of the same effect. Given that knowledge about GSS and non-GSS group performance is important, studies of group interaction and the resulting gains and losses are needed. If this course is taken, GSS research can produce knowledge that will allow for generalizations across environmental, organizational, group, and decision factors necessary for the next generation of GSS and SDM research.

We also have sought to provide a thorough and up-to-date review of the empirical GSS literature. This thoroughness was important because of our focus on a specific context and task in illustrating gaps between items in the literature (i.e., Benbasat and Lim 1993; McGrath and Hollingshead 1994). We covered significantly more studies (see the References for those studies included in this and others reviews) than other reviews. However, as with any review, it was not possible nor feasible to explore all the areas of inquiry related to groups, technology, decision making, and performance.

The potential benefits of GSS for SDM made this exploration important, because (a) these are the decisions that have a wide and permeating effect on organizational survival and performance and (b) these decisions are becoming more complex as the availability of information increases (Stamen 1990). Along with the failures of GSS in organizations because of inattention to social processes by developers (Grudin 1994), the study of GSS and SDM is an area ripe for study and enterprise. We hope that this paper helps establish a basis for scientific discourse for SDM in GSS groups and that it provokes the reader to voice a different view or provides justification for new research.

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Notes

1. Although the executive information systems literature also deals with SDM, it does so with a focus on the individual and therefore is outside the scope of our thesis (Leidner and Elam 1993).

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*The superscript number is used to cite the study in the tables.
[a]The study is included in Benbasat and Lim's (1993) meta-analysis.
[b]The study is included in McGrath and Hollingshead's (1994) review.
[c]More than one data set is reported.
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