An Extended Framework for GDSS Research

Moo-Jin Choi*
Dal-Ho Son**

Keimyung University
* Department of MIS
** Department of Business Education

ABSTRACT

This paper proposes that a GDSS research boundary needs to be further expanded to include more human-nature variables arizing in natural group interaction processes. By doing so, we can better understand the GDSS phenomena and have a better picture for designing effective GDSS for group decisions. Specifically, this paper reviewed literature and explored variables to be further included in GDSS research arena. As results, this paper proposed an extended framework for GDSS research that includes variables that have been little considered in most empirical studies to date. Then, the variables and their relationships are used to explain the handicaps of current GDSS uses and to redirect the ways of utilizing GDSS technologies for group decision-making. Based on the framework, we suggested propositions for the future research.

1. Introduction

Rapidly changing business environment and escalating demand for quick and sound decision-making have managers consider the effectiveness of group decisions seriously. Goods and bads of "groupthink" have been widely awared, therefore, numerous group theories and decision aids have been developed to improve group performance (Janis 1971; Hackman and Morris 1975; Maier 1980; Napier and Gershenfeld 1981). Recently, technological advancements in electronic conferencing, local area networks, and various group support softwares have unfolded a new path to improving group meeting effectiveness.

Group decision support systems (GDSS) is an evolvong technology that combine communcation, computer, and decision technologies to support problem formulation and solution in group meetings (DeSanctis and Gallupe 1987). Various group intervention techniques (e.g., brainstorming, Nominal Group Technique, Delphi method, decision analytic techniques, alternatives evaluation techniques, etc), once implemented by human facilitators , are now imbedded in GDSS features. DeSanctis and Gallupe (1987) argued that group decision supports start with Level 1 GDSSs and are further developed into Level 2 and Level 3 GDSSs. Level 1 GDSSs primarily aims at removing common communication barriers by providing large screens for instantaneous display of opinions, voting solicitation and compilation of the results and anonymous communication. Level 2 GDSSs provide decision modeling and group decision techniques aimed at reducing uncertainty and "noise" that occur in group's decision process. Level 3 GDSSs are characterized by machine-induced group communication patterns and include expert advices in selecting and arranging of rules to be applied during a meeting.

All these developments are led to, as has been often the purpose of most ITs, eliminating as much human intervention (or influence) as possible during group meeting process by infusing computer-mediated technologies. For example, the introduction of anonymous communication via electronic conferencing may alleviate a dominance of a few distinguished figures (often formal leaders or facilitators) and increase a participation of restrained minority. As results, members generated more comments, were more critical, and were more likely to embellish ideas proposed by others (Jessup et al. 1990; Connolly et al., 1990). Such presumptions and conclusions are manifaest in most empirical GDSS reserach, and their handicaps have been noticed in many findings. For example, Gallupe and DeSanctis (1988) compared the effectiveness of GDSS-supported and nonsupported decision-making groups handling a crisis management task. They found that decison quality was significantly better in those groups that received GDSS support, but, however, members' decision confidence and satisfaction with the decision process were poorer in the GDSS-supported groups than in the no-support groups. Then, they questioned what precise causes of more negative sentiments on the part of group members who used a GDSS are. Connolly et al. (1990) also report that identified groups working with a supportive confederate were more satisfied and had the highest levels of perceived effectiveness than the anonymous groups supported by an "Electronic Brainstorming" system.

Therefore, we argue that, to date, GDSS technologies tend to be viewed as a substitute for verbal communication, flipcharts, note pads, manual decision-aids, human facilitator or leader, etc that have been accepted as traditional aids in group meetings over centuries. We further argue that GDSS technologies should be designed and implemented in consideration of a social and organizational context. The technologies should be deployed to complement drawbacks of traditional group meetings methods and leave some social and emotional cues intact for selected tasks (e.g., emotion or value-involved issues). Some GDSS technologies may deprive members' motivation for contribution and sense of responsiblity, and may have members to settle down with mediocre, impractical solutions. Therefore, a drive for automating entire group meeting processes and eliminating human interventions may take a risk of users' resistance to GDSS technologies.

For this, we propose that a GDSS research boundary needs to be further expanded to include more human-nature variables arizing in natural group interaction processes. By doing so, we can better understand the GDSS phenomena and have a better picture for designing effective GDSS for group decisions. Specifically, this paper reviewed literature and

explored variables to be further included in GDSS research arena. As results, this paper proposed an extended framework for GDSS research that includes variables that have been little considered in most empirical studies to date. Then, the variables and their relationships are used to explain the handicaps of current GDSS uses and to redirect the ways of utilizing GDSS technologies for group decision-making. Based on the framework, we suggested propositions for the future research.

In the following section, major problems noted in GDSS research are discussed. Then, an extended framework for GDSS research is presented, and major blocks of variables are discussed in detail.

2. Problems

Much of GDSS literature rests on the assumption that the addition of electronic aids to verbal information exchange will lead to the following intended consequences: better decision and actions and higher productivity (Watson, DeSanctis, and Poole, 1988). The electronic media allow greater participation in decision making and increase access to a pool of group information. As results, resources of a group are fully exploited in a group intercation process; a more democratic decision process should emerge; and some structure should be added to what is otherwise a "muddling through" process for groups (DeSanctis and Gallupe, 1987; Huber, 1984a; Gray, et al., 1981; Rohrbaugh, and Wehr, 1978). Many studies report positive results of GDSS. Lewis (1982) and Gallupe (1985) found that groups supported by a GDSS make higher quality decision than groups without a GDSS. Applegate (1986) and Steeb and Johnston (1981) have shown the usefulness of GDSS in planning task. Positive effects of a GDSS on group decisions have also been reported by Gray et al. (1981), Turoff and Hiltz (1982) and Siegel, et al. (1986). Siegel, et al. (1986) report that computer aids have fostered a democratic group process, with more equality of participation among group members. Improved satisfaction with the decision process has been also reported (Applegate, 1986), as well as a greater shift away from initial individual preferences (Siegel, et al., 1986).

On the other hand, as Kiesler (1986) points out, the addition of an electronic aids for interpersonal communication can bring about some negative, unintended effects as well. For example, the use of keyboard input and the greater volume of informaton flow can add to the level of effort required in a group meeting, thus lowering group efficiency. Similarly, hightened awareness of members' viewpoints and greater objectivity in reviewing proposed ideas or solutions to a problem may raise the level of conflict in the group interaction process. Several other studies report that higher levels of conflict and negative emotional expression in computer-mediated communication than in face-to-face communication (Applegate, et al., 1986; Siegel, et al., 1986; Gallupe, 1985; Gallupe and DeSanctis 1988). These unanticipated negative effects may counteract or wash out the gains realized from a GDSS (Watson, DeSanctis, and Poole, 1988). In summary, there is no guarantee that systems generating high decision quality will also generate high user satisfaction (Turoff and Hiltz 1982).

At this point, one question is "Does really GDSS improve the communication among group members and eventually increase group performances: especially individual's confidence on decisions, group consensus and members' satisfaction on group interaction process and outcomes that have been often negatively affected by GDSS?" (Gallupe and DeSanctis 1988; Connolly et al. 1990). Specifically, Watson, et al. (1988) made a strong argument for supporting one presumption: GDSS can facilitate expression of existing conflicts among members, without creating new conflict, and, therefore, simply provides a mechanism that brings out existing differences among members and helps improve group consensus. They found that for each of the three treatment groups (GDSS-supported, manual-support, and no-support groups), the average level of consensus improved and the variance in consensus was reduced following the group meeting. But the post-meeting consensus was highest in groups receiving the manual decision aid. It seems, therefore, that GDSS support does not create additional conflict, but is not particularly effective for cultivating group consensus compared to the

manual groups.

Watson et al. (1988) also reported that the manual groups were the most confident that their solution was correct, and the least confident were the baseline groups. Again, the GDSS is not particularly useful for improving group members' confidence on their decisions.

Jarvenpaa et al. (1988) compared the effectiveness of group meetings supported by (1) networked workstation technology, (2) electronic blackboard (EBB) technology, and (3) conventional group communication technology, i.e., traditional notepads, pencils and a flipchart. They found that the conventionally supported meetings appeared to result in the highest level of communication thoroughness, followed by the EBB-supported meetings. The intensity of communication seemed to vary greatly from team to team supported by an identical technology, although the teams were of the same size. But they didn't explain why they differed. They also found that the types of support do not statistically affect the equity of participation in group meetings. In terms of quality of team performance, the computer supported meetings resulted in higher performance than the conventional meetings. The quality of team performance was measured by ratings given by experts in software design problems who were not participants of the experiments. There was no significant difference in satisfaction for three types of groups. But three teams showed significnatly different satisfaction on the meetings.

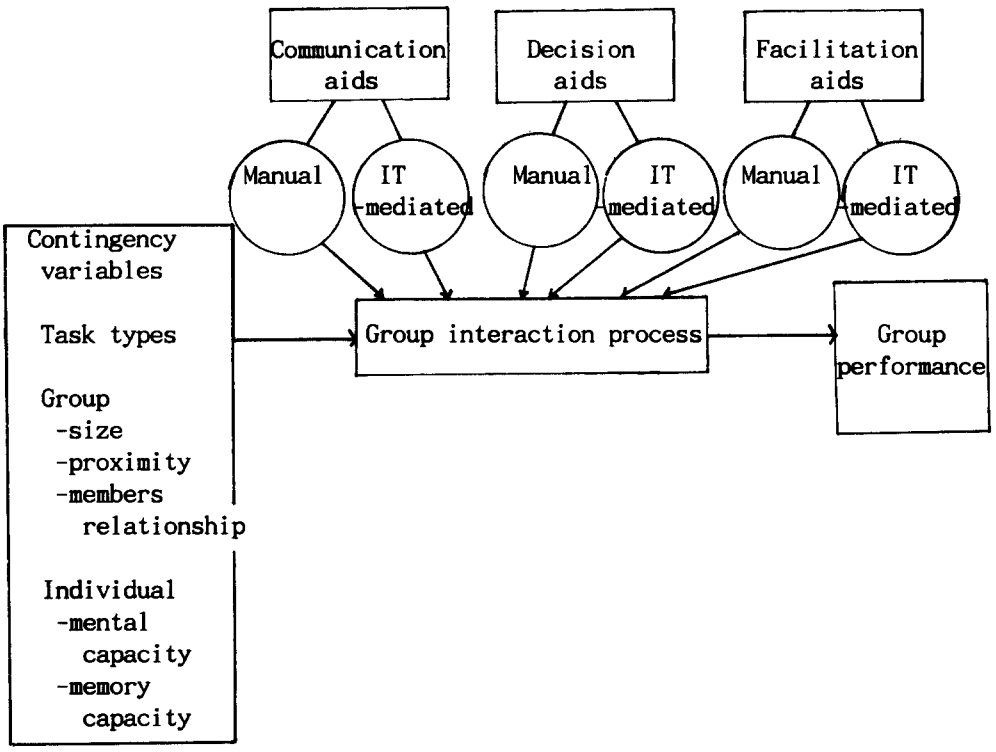
The survey of above studies leads us to conclude that it is hard to place a strong confidence on the effectiveness of IT-mediated communication aids, particularly improving member's confidence and satisfaction on decisions and group consensus. GDSS seems to be effective for improving group's task-related productivity, but not much helpful for satisfying members' social needs (satisfaction, tension release, consensus, cohesiveness) and members' confidence on group decisions. We may wish that the positive outcomes of GDSS outweigh the negative effects, but weighing both sides is still questionable.

The next question is how to increase group's task-related productivity while improving or at least maintaining member's acceptance and confidence on group decisions and group consensus that are important factors for a successful implementation of decisions arrived. Encouraging communications that deal with group members' feeling are important for members' acceptance for the solution and their willingness to work together in the future (Miner 1979). Therefore, DeSanctis and Gallupe (1987) suggested that GDSS technologies should aim to support both the social needs of groups as well as their task-focused activities.

For this, we propose that GDSS should be characterized by a combination of IT-mediated aids and well-tuned human interventions to best achieve group performances. Therefore, the following extended framework discusses variables that have been little considered in GDSS literature to date: various group factors and facilitation aids.

3. An Extended Framework

Figure 1 shows an extended framework for GDSS research. Five major categories of variables are i) group interaction process, ii) contigency variables that affect the group interaction process, iii) types of aids that intervene the group interaction process to improve iv) group performances. Similar framworks were suggested by Poole and DeSanctis (1987) and Hackman and Morris (1983). Poole and DeSanctis (1987) suggested a general model of the relationship of GDSS technology to other group variables where both GDSS technology and other situational variables affect group interaction process that, subseguently, determines group outcomes. Hackman and Morris's (1983) framework shows the relations among certain input variables, group interaction process, and three summay variables in influencing group performance effectiveness. Our framework differs only in an elaboration of group intervention modes. The intervention modes are divided into 1) communication aids, 2) decision aids, and 3) facilitation aids. Each type of aids can be provided in either manual or IT-mediated mode. The explicit division of intervention modes is useful for drawing research issues that explores the questions: how to increase group's task-related productivity as well as improving or maintaining individual's acceptance and confidence on decisions and group consensus.



<Figure 1> An Extended Framework for GDSS Research

3.1 Group interaction process

The necessity of anlayzing group interaction process in GDSS research was first emphasized in Zigurs et al. (1988) and Zigurs (1989). Most GDSS research has focused on the effects of computer support on outcomes such as decision quality or group consensus rather than on decision processes. Since GDSS is a social technology that impacts the pattern of interaction in a group (Poole and DeSanctis 1987), the effects of group factors and intervention modes on the interaction process are of great interest.

Many behavioral and cognitive tendencies of group members throughout the (natural) group interaction process take place. In this section, only four tendencies are addressed: i) an intent of influencing other members, ii) a motive for contribution, iii) a motive for reducing cognitive conflicts arizing among members, and iv) a motive for reducing individual's cognitive conflicts and loads. The cognitive conflicts arizing among members has a nature of interpersonal as well as collective (Sengupta and Te'eni 1993), while individuals also desire to overcome a lack of insight into decision strategies and inconsistency in executing their intended decision strategies caused by their generic cognitive limitations (Hogarth 1987; Dawes and Corrigan, 1974).

First, most group members have an intent of influencing others as much as possible in group meetings (Zigurs, Poole, and DeSanctis 1988, Zigurs 1989). Influence implies attempts to move, affect, or determine a course of action (Bass, 1981). The influence construct has a heavy procedural component. Behaviors that represent influence in decision-making groups might include agenda-setting, discussion of group goals, summarizing of group opinions, an attempt to implement action, and general discussion of process. When some member's intent is strong, and others are restrained to speak out due to many reasons, the group interaction is likely to be dominated by a few members and leave minority quiet. The belief that equal participation of group members results in higher quality decisions is based on research on structured group processes (Van Gundy, 1981; Zander, 1982). The influence attempts are made through available channels of communication: verbal, nonverval, or written (Zigurs 1989). It appears that, in organizational settings, the use of electronic

media increases participation by otherwise reticent members (Foster and Flynn 1984; Sproull and Kiesler 1986). More specifically, it has been argued that GDSS features including anonymous communication and turn-taking are aimed at increasing participation of all members to improve overall group performance (Steeb and Johnston 1981; Jarvenpaa et al. 1988). Jessup et al. (1990) investigated the effects of anonymity on GDSS group process with a idea-generating task. They found that, even though not statisticaly significant, groups working anonymously are more likely to be critical of other's idea, to ask questions about other's idea, and to clarify or add to their own and other's idea. The anonymous groups also generated more ideas and comments than did groups working under idenfified conditions. However, their study did not measure how much the meetings satisfied the members' social needs: group consensus and members' satisfaction on group interaction process and outcomes, and also did not explain how the anonymity influences the participation patterns of group members. Therefore, we are still not clear on whether the improved performance was due to increased participateion of all members overall or of minority who had been restrained otherwise. Connolly et al. (1990) also report effects of anonymity on idea generation in computer-aided communication groups. They found that GDSS-supported groups generated more output when anonymous to one another, and when the evaluative tone of their group was critical rather than supportive. Watson, DeSanctis, and Poole (1988) examined a hypothesis about the effects of GDSS on equity of influence among group members. The equality of influence among group members was most equal in the GDSS groups and most unequal in the baseline groups. In their study, GDSS features including secondary commnucation channel, public display, and alternative evaluation support features (rating, rankings, votes, etc.), called Level 1 GDSS (DeSanctis and Gallupe 1987), were incorporated in their lab test. Therefore, the outcomes, the equality of influence, might be mixed, aggregated effects of multiple GDSS features rather than IT-mediated communication support alone. Therefore, in summary, whether anonymous communication and/or turn-taking have a positive effect on improving participation of all group members has not been confirmed yet.

Therefore, Rao and Jarvenpaa (1991) proposed a relationship rooted on the minority influence theory as follows: "anonymity allows members to express ideas without fear of disapproval from either other group members or authority figures and also prevents members from copying ideas of high- status individuals."

Secondly, group members have a natural tendency of making as much contributions as possible. Whether members' strong motive for contribution has positive effects on the group performance or not is not clear-cut. The motive may emerge in a way of either taking more turns for speaking or making more contributory, high-quality comments, or both. Hackman and Morris (1983) argued that the group interaction process determines the level of effort the group applies to carrying out an assigned task, which eventually affects group performance. Further, a factor that powerfully affect the level of group effort is the norms of the group, but much less known about what determines whether the norms will encourage high or low effort on the task (Hackman and Morris 1983 p. 367).

Despite the motive for contribution is an important factor for improved group performance, this aspect of group interaction process has been little addressed in GDSS literature. It is not clear yet which GDSS features (i.e., anonymous communication, turn-taking) generate higher motive for contribution of the groups overall, drive up their efforts at the group task, and then, can improve the group performance. Another way of looking at the motive-group performance relationship is that the GDSS features may discourage members with strong motive for contribution and encourage reticent members to be more active, enhance the equal participation of all group members, and then, improve the group performance. The unanswered question is, between the balanced, equal participation of all group members and the increased motive for contribution, which outcomes better improve the group performace and how much. This whole 'black-box' has been little probed yet. To date, little GDSS research addresses technologies that can encourage the motive for contributions of all group members, instead, there is a plenty of cases where GDSS are primarily used for improving minority's motive for participation.

One exception of this argument can be found in Connoly, Jessup, and Valacich (1990). They

attempted to evaluate the effects of anonymity and evaluative tone on computer-mediated group using GDSS to perform an idea-generation task. The evaluative tone was manipulated through a confederated group member who entered supportive or critical comments into the automated brainstorming system. Their findings are: (i) group generated more output when anonymous to one another, and when the evaluative tone of their group was critical rather than supportive; (ii) participants reported themselves as more satisfied with the group's process and outcomes when the evaluative tone was supportive rather than critical. Assuming that the evaluative tone may be served as a medium for triggering members' motive for contribution, the factor that affects members' motive for contribution controlled by human interventions was first included in their study. Based on their findings, the authors conjectured that the productivity of generating ideas was enhanced by the disinhibiting effects of anonymity, but that the evaluation had a cuing, not pure motivational, effect. When a subject posed an idea and received an approving comment, he or she tended to interpret this as a signal that idea was adequate and complete, and that no more work on that idea, or subsequent ideas, was required. In other words, the supportive evalutions degraded the group's effort for idea generation, but generated increased satisfaction on group's process and outcomes.

The intent of influencing others and the motive for contribution are not totally independent constructs. They may be two sides of one coin and often are intermingled factors that influence the group interaction process.

Third, group members have a natural tendency of making best effort in minimizing cognitive conflicts arizing among members (Senguta and Te'eni 1993). An unhealthy way of resolving the conflict, as Nemeth (1986) argued, is that group members favor and accept a majority opinion without questions. Then, the minority won't raise any opposing opinions, and the group may not have a chance to reexamine the alternatives for better and noble solutions.

To date, three types of intervention for reducing cognitive conflicts seem to appear in GDSS literature: the first one is the intervention of special human agents (Connolly et al., 1990); the second is providing cognitive feedbacks imbedded in GDSS environment (Senguta and Te'eni 1993), and the third is providing GDSS including secondary communication channel and public display that are not proven to be effective yet (Jarpenpaa, Rao and Huber 1988). Watson, DeSanctis and Poole (1988) examined the effects of a GDSS in resolving conflicts of group members' preference. As results, post-meeting consensus was higher in groups receiving the manual decision aid than in other two groups (i.e., GDSS-support groups and baseline groups). In their study, the GDSS groups were provided with primarily Level 1 GDSS such as entering individual ideas, messages, and evaluation scores through private terminals and displaying them in public screen. Based on their description only, it is not certain which features among secondary communication channel, public display, turn taking, and anonymous communication were incorporated in their experimental settings. Therefore, it can not be confirmed through which medium and how the group's conflict has been lessen.

Assuming that cognitive conflicts among group members can be reduced by communciation throughness during group interaction process, it is worth to note findings of Jarvenpaa, Rao, and Huber (1988). They found that conventionally supported meetings appeared to result in the highest level of communication throroughness, followed by the electronic blackboard-supported meetings. Besides, workstation-supported meetings manifested the lowest level of communication throroughness. Based on the two studies, GDSS including secondary communication channel and public display does not seem to play a significant role in reducing cognitive conflicts among group members.

As an another measure to control cognitive conflict arizing in group settings of GDSS environments, Senguta and Te'eni (1993) examined the effects of cognitive feedbacks on the group meeting performance. They found that groups receiving cognitive feedbacks are more likely to lessen cognitive conflicts arizing between group members in group sessions. In their study, the cognitive feedbacks were provided with graphics that summarizes group members' judgement or rating through individual terminals.

Finally, Connolly et al. (1990) found that group members reported themselves as more

satisfied with the group's process and outcomes when the evaluative tone was supportive rather than critical, and tended to report in the same direction when they were identified rather than anonymous. In their research, evaluative tone was manipulated through a confederate group member who entered supportive or critical comments into their automated brainstorming system.

Finally, individuals in groups often experience cognitive conflicts and information-processing overloads. The cognitive conflicts arize from individuals' self-evaluation on the soundness, consistency and rationality of his/her judgement, rating, selection in decision making processes in the level of individuals. Often individuals' cognitive capacity are overloaded due to many computational works and too many variables to consider (Te'eni, 1991; Senguta and Te'eni, 1993). Many ways for relieving cognitive conflicts and expanding cognitive capacity of individuals have been discussed. One is providing decision makers with cognitive feedbacks. Sengupta and Te'eni (1993) investigated the effect of computer generated cognitive feedback in computer supported group decision processes. They found that providing cognitive feedbacks (each member's weights and consistency) helped users better handle their cognitive conflicts over periods. Therefore, they suggested that GDSS developers should include cognitive feedbacks as an integral part of the GDSS. Their research has an implication for the extended framework: an usefulness of a built-in feedback mechanism for GDSS software, expecially Level 2 GDSSs. It is named as IT-mediated facilitation mode under the framework. Such feedback mechanism may or may not successfully replace some roles of facilitors (or formal leader) who have traditionally directed meetings (Maier, 1980; Fiedler, 1980; House and Mitchell, 1983; Rotemberg and Saloner, 1993). However, the proposition has not been confirmed yet.

3.2 Group intervention modes

There are many alternative ways to intervene group interaction process for improved group meeting performance. In this model, typical group intervention modes are classified into i) communication aids, ii) decision aids, and iii) facilitation aids that can be implemented in either comupter-supported or manual in an group interaction process. The former two, communication aids and decision aids, are widely accepted categories of GDSS technologies in most GDSS literature, whereas the last one is not. However, utilities of the three group intervention modes are viewed from the four natural tendencies arizing throughout group interaction process: i) an intent of influencing other members, ii) a motive for contribution, iii) a motive for reducing cognitive conflicts arizing among members, and iv) a motive for reducing individual's cognitive conflict and loads.

Communication aids and its effects on group effectiveness

Communication aids, both manual (e.g., speech, flipchart, sending memo etc.) and computer-mediated (secondary electronic communication channel, public display, etc), are media for helping effective exchange of information among group members. Computer-aided communication technologies have been named in many terms: "Level 1 GDSS" (DeSanctis and Gallupe 1987); GCSS (group communication support system), a distingushed term from GDSS (Kraemer and Pinsonneault 1989). A clear distinction of various GDSS technologies are critical for building sound theories in GDSS (Rao and Jarvenpaa 1991).

Literature often implies two pathways to improve the effectiveness of group communication. One way is to reduce communication barriers arizing in typical group meetings. DeSanctis and Gallupe (1987) used the term, Level 1 GDSSs that primarily aim at removing common communication barriers through large public screen, voting solicitation and compilation, anonymous input of ideas and preferences, and electronic message exchange between members. Jarvenpaa, Rao, and Huber (1988) mentioned communication throughness as a variable that depicts the effectiveness of group meetings. The communication throughness among group members can be increased by reducing various sources of noise including overloaded channels, interruptions, multiple discordant stimuli, etc. (Rao and Jarvenpaa

1991). They postulated that three computer-aided communication supports (turn-taking, secondary communication channels, and public display) may reduce the noise, and then, improve communication based on the communication theory.

Another way of improving the communication effectiveness is through increasing participation of minority. Rao and Jarvenpaa (1991) explictly divided computer-supported group technology into (1) ones to support for improved communication and (1) ones to provide for increased participation. Specifically, they classified i) anonymous communication and ii) turn taking as supports for improving participation of minority and i) secondary communication channel, ii) public display, and iii) turn taking as supports for improved communication. They dropped the voting solicitation and ranking features from the categories of GDSS supports to explain inconsistent findings of recent GDSS research. They further argued that such distinction can help better understand the underlying causes of inconsistent results in GDSS reseach. Often the mix of GDSS features in experimental settings is not prudently selected due to unclear understanding of various GDSS features. This led to not abling to build new research on the previous findings.

Many studies examined the relative effectiveness of group meetings proceeded in a traditional manner or with computer-aided communication support. Connolly et al. (1990) and Jessup et al. (1990) evaluated effects of anonymous communication via "Electronic Brainstoming" system on an idea generation task. Groups working anonymously and receiving critical comments produced the greatest number of original solutions and comments. However, in Connolly et al. (1990), the improved performance was due to not only computer-mediated anonymous communication but also the evluative tone, a measure of enhancing members' motive for contribution. Therefore, the degree to which each variable accounts for the improved group performance was not clearly stated. Gallupe and Cooper (1993) reported a research showing that electronic brainstorming groups are more productive in generating and evaluating ideas than groups that use traditional, oral brainstorming and parcitipants likes the process more.

Decision aids and its effects on group performances

The second category of group intervention modes is decision aids, both compuer-supported and manual. The utilities of decision aids for group meeting can be rationalized from limited information processing capability of human beings (Rao and Jarvenpaa 1991). In literature, decision aids have been called 'Level 2 GDSS' (DeSanctis and Gallupe 1987) or 'GDSS (group decision support system)' (Kraemer and Pinsonneault 1989), or computer-based group technology used to provide computational support for tasks (Rao and Jarvenpaa 1991). As noted by Watson et al. (1988), there are only a few studies that used decision aids in GDSS environment (Applegate, 1986; Steeb and Jonston, 1981). Therefore, there are a plenty of issues to be further explored: examining the effects of decision aids on group performances in a group context, design and implementation issues, etc.

Facilitation aids and its effects on group performance

It has been long since the group processes have been intervened in many ways. Basically, the facilitation aids can be classified into a manual mode and an IT-mediated mode. Without a GDSS, meetings should be presided by a human facilitator (or a formal leader). The facilitator may request members to bring up ideas for selecting agenda, to discuss techniques to bring up ideas on selected issues, to suggest alternative voting methods and to conclude the meeting. With a GDSS, the facilitation is approached differently. Dickson et al. (1993) identified three "support modes" that indicate the manner in which a group of individuals use a GDSS. First, no facilitative support is available since all GDSS features are built-in at each user teminal, and members are fully trained to use its features in any way and in any order (Gallupe et al., 1988; Zigurs et al., 1988). Thus, there is no room for a facilitator. The second mode is a task facilitative support where a person, not a member of the group, is utilized to aid the GDSS session (facilitator-driven type) (Dennis et al., 1988; McCartt and Rorhbaugh, 1989). The third one is an operational facilitative

support (chauffeur-driven type) (Jarvenpaa et al., 1988). A chauffeur simply implements features of the GDSS system for the group and does not influence the group process, whereas the facilitator acts as a process leader who plays a major role in how the group uses the technology in performing its task.

Until recently, little GDSS research has addressed the impacts of the facilitation modes on the group processes and outcomes. Early GDSS research conducted at the University of Minnesota did not examined the effects of facilitation modes (e.g., Gallupe et al., 1988; Watson et al., 1988; Zigurs et al., 1988) - all were without any facilitatve support (i.e., user-driven mode). Dickson et al. (1993) was first to examine the impacts of facilitation modes on the group performances. Their findings are: i) chauffeur-driven groups had higher levels of post-meeting consensus than the facilitator-driven groups; ii) user-driven systems are at a disadvantage to the other two support modes in achieving group post-consensus. They also drawn a useful discussion about facilitator effects. Different facilitators can result in different degrees of facilitation effectiveness depending upon individual characteristics or skills.

As Dickson et al. (1993) claimed, a series of the above research has built off classical small group research (Maier, 1970). However, as human facilitators engage in the group interaction process even under GDSS context, there appears a bundle of whole new factors that affect group performances: individual characteristics, level of facilitator skills, facilitation style, etc. Therefore, the necessity of complementing drawbacks of IT-mediated aids with an appropriate intervention of human beings can be proposed. If the types of facilitators were further expanded to include a formal, effective leader, a new breed of facilitation mode can be proposed. The facilitation aids may consist of well-trained, effective facilitators (or formal leaders), GDSS features supporting the facilitator and GDSS for group members. Efforts for this direction may overcome the current limitations of GDSS demonstrated in many studies: GDSS is not an effective aid for meeting members' social and emotional needs and obtaining a group consensus that are important for successful implementation of decisions made.

To date, GDSS research has not applied clear-cut categoreies of these intervention modes in experiment settings. For example, Gallupe et al. (1988), Watson et al. (1988), Zigurs et al. (1988) used GDSS, "Software Aided Meeting Management (SAMM)," that included functions of recording, storing, and displaying problem definitions, and of criteria for evaluating solutions, alternative solutions, and a final group decision. In addition, the system could cummulate and display ratings, rankings, and votes associated with one or more alternative solutions to a problem. According to DeSanctis and Gallupe (1987), while the SAMM is Level 1 GDSS aiming at removing common communication barriers, some features are not pure communication supports (secondary communication channel, public display, turn taking) based on Rao and Jarvenpaa (1991). Therefore, the group outcomes might be a mixed, aggregated effect of more than one category of GDSS features rather than comuter-mediated communication aids alone.

4. Contingency Variables

There are many contingency variables that can affect the group interaction processes and outcomes. Poole and DeSanctis (1987) named these variables as "other situational variables"; Hackman and Morris (1983) as "input variables" (e.g., group task design, group norms, group composition); Gray (1986) as "input" (e.g., group-level factors, individual-level factors). A general conceptual framework of McGrath (1984, p.13) depicts the group interaction process as the consequence of the properties of the group's members, their patterned relationships, the task situation and the broader environment in which they are working. Specifically, Jarvenpaa et al. (1988 p. 663) mentioned the necessity of including team differences in GDSS research; Connoly et al. (1990 p. 699) suggested to include mutual liking of group members in GDSS research. Rao and Jarvenpaa (1991) proposed that the effects of GDSS (particulay anonymous communication) may vary depending upon member characteristics and group task types.

Despite the importance of group factors in GDSS research, little studies have addressed this issue. Group factors mentioned in GDSS research to date are task type, level of task difficulty, group size, group norms or cohesiveness, group composition, member proximity, facilitation modes, etc. Among these factors, most GDSS research has dealt with a single type of group task and a single level of task difficulty, and the group size were often 3-4 persons. As exceptional studies, Gallupe and DeSanctis (1988) used two levels of task difficulty, and Dickson et al. (1993) examined the effects of facilitation modes on post-meeting group consensus. Therefore, the effects of various group factors on GDSS performances are subject to wide-open questions.

5. Group performances

The purpose of GDSS is to increase the effectiveness of decision groups by facilitating the interactive sharing and use of information among group memebers and also between the group and the computer (Huber 1982). The effectiveness of GDSS use has been measured in various constructs for research purposes. In general, the measures can be classified into two categories: decision performance variables and members' perception variables (Gallupe and DeSanctis 1988). Decision performance was further divided into decision quality and decison alternatives. Decision quality was measured along decision content - how close the groups's decision was to that made by experts; decison reasoning - the degree of similarity between the group's reasoning in arriving at their decision and the expert's reasoning (Gallupe and DeSanctis 1988; Steeb and Johnston 1981). The number of decision alternatives were defined as those issue that the group considered to be possible major problem causes in the case and hence, possible solutions to the decision task. Group members' perception were further divided into group decision confidence and group satisfaction (Gallupe and DeSanctis 1988).

* This paper needs a further refinement and reorganization.

** The references are available upon request.