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GDSS연구결과의 일관성 결여를 설명하는 요인들에 관한 연구

전 기 정, 박 흥 국[1)]

Examining Factors for the Inconsistent Findings in GDSS Research

The growing popularity of Group Decision Support Systems (GDSS) has been supported by, and has given rise to, a burgeoning academic literature on GDSS since the mid-1980s. Although there is a growing body of laboratory experiment findings, the results are inconclusive. Field studies in real organization settings show all the more different results form the experimental studies.

This paper systematically reviews the existing case, field, and laboratory decision room type GDSS studies. It, then, explores the plausible reasons for the inconsistent findings across the laboratory studies, and especially between field and laboratory research. It suggests five main factors for the inconsistent findings in previous GDSS research: contextual pressures, tasks, group characteristics, technical configurations, and comparability of measures.

1) 상명여자대학교 정보처리학과

I. INTRODUCTION

Previous research conducted at various institutions reveals that even within adecision room type GDSS, there are considerable variations across system configurations, and how they are used in particular experiments. Basic things, like software design and functionality, room configuration, method of facilitation, and group process technique, differ remarkably from one GDSS to the other.

Basic assumption in the design of the decision room even within the multiple workstation type GDSS is also different from each other. Claremont (formerly SMU room) room [Gray et al., 1981; Gray, 1989] is based on the assumption that most executives do not type or do not like to type. Therefore, the individual terminals are touch screens and are menu driven. However, Minnesota [Gallupe et al., 1988] and Arizona [Nunamaker et al., 1988] rooms are based on the different assumption that previous experience or skill of keyboarding has little to do with actual GDSS usage. While some GDSS (e.g., Decision Conferencing) believe the importance of the facilitator, others (e.g., SAMM and DECAID of the University of Minnesota) do not.

The experiments designed to test the effects of a GDSS also differ from each other, along many dimensions. For example, to compare the results of using one software in one experiment, to those of using different software in a different experiment, can be misleading. While some research compares the effects of a GDSS to a manual structured process(MS), others compare GDSS groups to baseline (no support at all: NS) groups. The comparison of NS to MS permits determination of simple structure effects; the comparison of MS to GDSS permits determination of "pure" computer system effects; and the comparison of NS to GDSS groups permits determination of effects due to support versus no support [Easton et al., 1989; Watson et al., 1988]. So, comparing the results between studies without considering the differences between the phenomena being investigated with each research design can be difficult to interpret.

Given these differences, general statements about a GDSS also can be misleading, and it should hardly be surprising that findings from various GDSS research tell us different things. All of the findings across systems and across experiments must be interpreted carefully, because the findings are often the answers to different

research questions [Dennis et al., 1989; Gallupe et al., 1988; George et al., 1989].

However, contradictory results in current GDSS research also suggest the need for more exploration and comparison of how different technologies are used across a variety of circumstances, so that determining exactly what features of a GDSS provide the most effective and efficient support for specific types of circumstances [Gallupe et al., 1988; Jarvenpaa et al., 1988]. Kraemer and King (1986) suggest that an examination of the experiences with GDSS would provide valuable information about the promises, problems, and challenges involved in the technology. By examining the differences among previous studies, we are able to draw implications for the design of future studies [Dennis et al., 1989].

Therefore, current study aims to build on previous decision room type GDSS research findings and to provide possible reasons for the inconsistencies in the results of existing studies. The focus is more on identifying and summarizing the findings that have been researched rather than critiquing specific studies.

Ⅱ. Previous GDSS Research Review

1. GDSS effects on performance

Many GDSS experiments have examined the effects of a GDSS versus no GDSS support (either manual structured process which has the same structure as the GDSS or no structured support at all) on user performance. Typical variables are the quality of group decision making and decision time, which are usually examined by comparing subjects' (mostly students) sco rings with the experts'. This method, however, cannot be easily used to real world setting where users are already the specialists in their jobs. No one can know it as 〈Table 1〉 well as they do. As we can see below, previous GDSS research shows somewhat conflicting picture with regard to the two performance criteria: decision quality and decision time. A summary of previous research with regard to these two criteria is provided at table 1 and 2.

1.1. Experimental studies: decision quality

1.1.1. GDSS versus no support treatments

Table 1. Summary of experimental GDSS studies with regard to 2 performance criteria

	Decision quality	*Decision time*
University of Minnesota		
Gallupe ('86)	GDSS>NS (particularly, high difficult task)	GDSS=NS (regardless task difficulty)
Zigurs ('87)	GDSS=MS	
Watson ('87)		(GDSS=MS) longer than NS
Watson et al. ('88)	GDSS<MS,NS	
Gallupe et al. ('88)	GDSS>MSS (particularly high difficult task. due to depersonalisation effect of multi-station)	GDSS longer than MSS
Zigurs et al.('88)	GDSS=MS	
Gallupe & McKeen ('90)	GDSS=MSS	GDSS longer than MSS
Gallupe ('90)	GDSS=MSS In GDSS: best member>group>ave. member In MSS: best member=group>ave. member	
University of Arizona		
George et al.('88)	GDSS>NS	GDSS=NS
Easton, G. ('88)	GDSS=NS	GDSS longer than NS
Jessup et al. ('88)	GDSS>NS (due to anonymity)	
Easton et al.('89)	(GDSS=MS)>NS	(GDSS=MS) longer than NS
Others		
Lewis ('82)	GDSS>MS,NS	GDSS longer than MS, NS
Beauclair ('87)	GDSS=MS	GDSS=MS
Steeb & Johnston ('81)	GDSS>MSS (due to sensitivity analysis)	GDSS took 12 % longer than MSS
Bui & Sivasankaran ('90)	Low dif. task: GDSS=MSS High dif. task: GDSS>MSS	Low dif. task: GDSS longer High dif. task: GDSS=MSS
Sharda et al. ('88)	First 3 weeks: GDSS=NS Last 5 weeks: GDSS>NS	First 3 weeks: GDSS longer Last 5 weeks: GDSS=NS
Jarvenpaa et al. ('88)	EBB>EWS>NS	
VanSchaik & Sol ('90)	overall GDSS=no GDSS 1-5 sessions: GDSS<no GDSS 6-7 sessions: GDSS>no GDSS (but, predefined process is a much strong factor to improve decision quality than a GDSS.structure is more strong variable than the computer)	

* MS: manual structured process (same degree of structure with a GDSS),
MSS: manual semi-structured process (loosened structure than a GDSS),
NS: no structured support at all, EBB: electronic blackboard, EWS: electronic workstation.

Six studies have shown that use of a GDSS improves a decision quality compared to no upport at all treatment [Easton et al., 1989; Gallupe, 1986; George et al., 1988; Jarvenpaa et al., 1988; Jessup et al., 1988; Lewis, 1982]. While one study [Easton, G., 1988] has shown the use of a GDSS to have no effect on the decision quality, the other study [Watson et al., 1988] reports that decision quality of GDSS groups was lower than that of baseline groups, because users suffered from problems due to their lack of familiarity with the technolo-

gy. They, then, conclude that the group's cognitive struggle and procedural orientation due to the unfamiliar technology may imply that chauffeurs will be necessary in GDSS settings, or repeated use of a GDSS will reduce these problems. In fact, two longitudinal studies [Sharda et al., 1988; Van Schaik & Sol, 1990] have shown that in earlier stages of the use of a GDSS, decision quality of GDSS groups was worse or the same with no support groups; however, in later stages of a GDSS use, GDSS groups outperformed no support groups.

Therefore, some researchers [Chidambaram et al., 1990; Jarvenpaa et al., 1988; Sharda et al., 1988; Van Schaik & Sol, 1990; Watson et al., 1988] believe that learning through repeated use of a GDSS may be required before improved performance occurs. However, majority of studies reviewed here show that although their results were based on one time session experiment, the use of a GDSS improves a decision quality compared to no support at all treatment.

1.1.2. GDSS versus manual structured treatments

Results are inconclusive. Two studies found the use of a GDSS to improve decision quality [Lewis, 1982; Steeb & Johnston, 1981], while seven studies showed the use of a GDSS to have no difference in decision quality compared to manually structured method [Beauclair, 1987; Easton et al., 1989; Gallupe, 1990; Gallupe & McKeen, 1990; VanSchaik & Sol, 1990; Zigurs, 1987; Zigurs et al., 1988]. Two studies [Bui & Sivasankaran, 1990; Gallupe et al., 1988] have shown that the impact of a GDSS on decision quality is more visible when dealing with more difficult tasks. However, Watson et al. (1988) found that decision quality of GDSS groups was lower than that of manual structured groups, because users suffered from problems of technical unfamiliarity.

Majority of the research reviewed here show that there is no distinct difference in decision quality between GDSS and manually structured groups. However, the results also imply that we cannot ignore the possibility of improved decision quality from the use of a GDSS over manual treatment when dealing with particularly complex tasks, or from the repeated use of it.

1.2. Experimental studies: decision time

1.2.1. GDSS versus no support treatments

The use of a GDSS compared to no support treatments has been shown to increase the time required to make a decision [Easton, G., 1988; Easton et al., 1989; Lewis, 1982; Watson, 1987] or to have no effect on time required [Gallupe 1986; George et al., 1988]. Sharda et al. (1988) found that GDSS groups compared to no support groups took more time in the first three week time period, but showed no difference in the decision time taken in the last five week period. Despite the differences in system configurations, all of the research reviewed here reveal that there is no benefit from the use of a GDSS compared to a baseline treatment in terms of the decision time saved.

1.2.2. GDSS versus manual structured treatments

The use of a GDSS compared to a manually structured process has been shown to increase the time to reach a decision [Gallupe et al., 1988; Gallupe & McKeen, 1990; Lewis, 1982; Steeb & Johnston, 1981] or to have no effect on time required [Beauclair, 1987; Easton et al., 1989; Watson, 1987]. While one study [Lewis, 1982] found a GDSS took longer time than a manual structured or a no support process, two other studies [Easton et al., 1989; Watson, 1987] found no time difference between structured supports (either a GDSS or a manual structured), but the structured process group took longer than the no support group. While Gallupe (1986) found that GDSS groups took the same time with no support groups irrespective of the task difficulty, Bui and Sivasankaran (1990) reported that GDSS groups compared to manual structured groups took longer time in dealing with low difficult tasks, and took the same time when handling high difficult tasks. Watson et al. (1988) argue that the electronic medium associated with GDSS should allow the structure to be invoked and applied more quickly than is possible with a manual system. However, research reviewed here again shows that there is no benefit from the use of a GDSS compared to a manual treatment in terms of the decision time saved.

1.3. Field studies

All of the research results from case and field studies, irrespective of their differences in GDSS conceptions and facilities, show that participants report enhanced decision quality and shortened meeting time with the use of a GDSS compared to a similar conventional meeting

(see table 2).

Especially, Nunamaker et al. (1989) report that 55% of time saving (in terms of project duration, number of meetings, and person-hours) has been achieved with the use of a GDSS (here, Plexsys systems) at IBM sites. Phillips (1989a) also notes that agreement is reached much more quickly with the use of a GDSS (here, Decision Conferencings) than it could be achieved by a conventional procedure. Interestingly, two field studies [Chun, 1993; Nunamaker et al., 1989] show that cognitive struggle of participants with the initial GDSS use can be removed by the employment of facilitators. Both studies show that results were independent of the number of sessions that users had participated in.

2. GDSS effects on user satisfaction

While performance is admittedly the primary dependent variable of interest in information system research, user attitudes (users' pqerceptions of their performance, their satisfaction with the decision process and outcome, and their intrinsic interest to the system) are also key issues [Lucas, 1978; Sprague, 1980]. In the case of a GDSS, user attitudes have been recognized as critical to acceptance and adoption of the technology specially in organizational settings [Dennis et al., 1990; Gallupe & McKeen, 1990]. However, like the results of performance variables, previous GDSS studies in user satisfactions show somewhat conflicting results not only between experimental and field studies, but also within experimental research (see table 3 and 4).

2.1. Experimental studies : satisfaction with process and outcome

2.1.1. GDSS versus no support treatments

While, four studies [Gallupe, 1986; Kull, 1982; Watson, 1987; Watson et al., 1988] reported that GDSS groups exhibited less satisfaction compared to baseline groups, two studies [Jessup et al., 1988; Lewis, 1982] reported the higher levels satisfaction from GDSS use. But, four studies [Easton, 1988; Easton et al., 1989; George et al., 1988; Jarvenpaa et al., 1988] found no difference in the level of satisfaction between GDSS and baseline groups. Jessup et al. (1988) interpreted the enhanced satisfaction with the outcome of GDSS groups as due to the anonymous function inherent in their system.

Overall, majority of research show that

Table 2. Summary of GDSS studies in real world settings with regard to 2 performance criteria

	Decision quality	Efficiency (mainly, decision time)
Decision Conferencing		
Weiss & Zwahlen ('82)	GDSS better (problem understanding is enhanced due to sensitivity analysis)	GDSS better
Adelman ('84)	GDSS better (due to structured facilitation and S.A.)	
Phillips ('85)	GDSS better (new intuitions emerge, and dig more deeply into the problem ,clartify thoughts using S.A.)	Quicker decision w/GDSS
Phillips ('86)	GDSS better (revenues and profit doubled next year)	Agreement reached more quickly
Volpato ('89)	GDSS better	
Plexsys System at University of Arizona		
Nunamaker et al. ('87)	GDSS better (due to EBS)	GDSS better (due to parallel processing)
Vogel et al. ('87)	GDSS better	GDSS better (particularly, larger groups)
Nunamaker et al. ('88)	GDSS at least as good as manual process	GDSS took longer in the beginning of the session
Vogel & Nunamaker ('88)	GDSS better (more ideas and creativity)	GDSS better
Nunamaker et al. ('89)	GDSS better	GDSS better (55% time saved)
Dennis et al.('90)	GDSS better	GDSS better
Vogel & Nunamaker ('90)	GDSS better (issues fully explored)	GDSS better (due to parallel processing)
Others		
Gray ('83)	GDSS better	
Gibson & Ludl ('88)	GDSS better (better quality of ideas due to Idea Dialog Mode)	No dif.
Zigurs et al. ('89)	GDSS better	

* S.A.: sensitivity analysis, EBS: electronic brainstorming

user satisfaction with the use of GDSS is not higher than that of no support treatments. It is, however, interesting to note that participants' satisfaction with GDSS use is varied according to the system configuration. All of the four studies which reported no difference in the level of satisfaction between GDSS and baseline groups, are facilitator-driven GDSS. But, three out of four studies which found decreased satisfaction from the use of a GDSS are user-driven GDSS.

2.1.2. GDSS versus manual structured treatments

Results are contradictory. Four studies found the use of a GDSS to result in enhanced satisfaction with the decision proc-

Table 3. Summary of experimental GDSS studies with regard to users' attitudes

	Satisfaction with		Decision Confidence
	Process	Outcome	
University of Minnesota			
Gallupe ('86)	GDSS<NS (regardless task difficulty)		GDSS<NS (regardless task difficulty)
Zigurs ('87)			GDSS<MS
Watson ('87)	GDSS<NS<MS	No dif.	
Watson et al. ('88)	GDSS<NS<MS (process is confusing due to technical novelty)		NS<GDSS<MS
Gallupe et al. ('88)	GDSS<MSS	GDSS<MSS	GDSS<MSS (regardless task difficulty)
Zigurs et al. ('88)	GDSS>MS (more adaptable)		
Gallupe & McKeen ('90)	GDSS<MSS (in FTF as well as remote setting)		GDSS=MSS
Gallupe ('90)	GDSS<MSS (In GDSS: best member=group, In MSS:best member>group)		GDSS<MSS
University of Arizona			
George et al.('88)		GDSS=NS	
Easton, G. ('88)	GDSS=NS		
Jessup et al. ('88)	GDSS better,FTF>remote (due to anonymity)		
Easton et al.('89)	(GDSS>MS)=NS	(GDSS>MS)=NS	
Others			
Kull ('82)	GDSS<NS		
Lewis ('82)	GDSS>MS,NS (feelmore creative)		
Beauclair ('87)		GDSS=MS	
Steeb & Johnston ('81)	GDSS>MSS	GDSS>MSS	GDSS>MSS
Bui & Sivasankaran ('90)		Low dif. task: GDSS<MSS High dif. task: GDSS slighly better	
Sharda et al. ('88)			No dif.
Jarvenpaa et al.('88)	EWS=NS		

* MS: manual structured process (same degree of structure with a GDSS)
MSS: manual semi-structured process (loosened structure than a GDSS)
NS: no structured support at all

ess compared to a manual structured treatment [Easton et al., 1989; Lewis, 1982; Steeb & Johnston, 1981; Zigurs et al., 1988]. But, five studies showed the use of a GDSS to dampen participants' satisfaction with the decision process [Gallupe, 1990; Gallupe & McKeen, 1990; Gallupe et al., 1988; Watson, 1987; Watson et al., 1988]. While two studies [Easton et al., 1989; Steeb & Johnston, 1981] reported

that the use of a GDSS enhanced participants' perceived satisfaction with the solution, Gallupe et al. (1988) found the decreased satisfaction with the outcome from GDSS groups. Other two studies [Beauclair, 1987; Watson, 1987] reported that there was no difference in the perceived satisfaction with the outcome between GDSS and manually structured groups. Bui and Sivasankaran (1990) reported that satisfaction with the outcome of GDSS groups was particularly increased when dealing with high difficult tasks.

Like the results in the previous section, participants' satisfaction with the GDSS use is strongly affected by the system configuration. Three out of four studies which reported improved satisfaction with GDSS use compared to a manual support, are facilitator-driven GDSS. But, all of the five studies which found decreased satisfaction are user-driven GDSS.

User-driven GDSS research [Gallupe et al., 1988; Watson et al., 1988] report that participants suffer from problems of technical unfamiliarity in their initial use of a GDSS. They interpret that the group's cognitive struggle to deal with technology can cause dissatisfaction, and sometimes impede the group's performance.

However, according to facilitator-driven GDSS research [Easton et al., 1989], the enhanced satisfaction of GDSS groups compared to manually structured groups could be attributed to the idea that computer groups thought a GDSS should help them produce a better decision, or that the computer might provide an easier mechanism to record and analyze the data than the use of flip charts.

2.2. Experimental studies: decision confidence

As we can see from table 3, five studies from the University of Minnesota found the use of a GDSS to deteriorate users' confidence about their decisions [Gallupe, 1986;1990; Gallupe et al., 1988; Watson et al., 1988; Zigurs et al., 1988]. Gallupe et al. (1988) interpreted this unexpected finding as follows: "Groups supported by the GDSS tended to generate more possible decision alternatives. They also considered those alternatives in more detail. Because of this condition, these groups had a more difficult choice to make, and once they made a decision, they were possibly less confident because of the number and quality of the choices." But, one study [Steeb & Johnston, 1981] also reported that GDSS groups generated more options

Table 4. Summary of GDSS studies in real world settings with regard to users' attitudes

	Satisfaction with		Decision Confidence
	Process	Outcome	
Decision Conferencing			
Weiss & Zwahlen ('82)	Better (people like fair, adaptable process)		Better (in implementation)
Adelman ('84)	Better (depersonalised process due to MAU model)		Better (well supported and implemented within and after GDSS meeting)
Phillips ('85)	Better (process for shared understanding)		Better
Phillips ('86)		Better(better and solution)	Better(common purpose and agreed action plan)
Volpato ('89)			Better
Plexsys System at University of Arizona			
Nunamaker et al. ('87)	Better (mainly due to Electronic Brainstorming)	Better	
Vogel et al. ('87)	Better (8 or more than 3-4 size groups)		Better (support the solution)
Nunamaker et al. ('88)	Better (particilarly, larger groups)		Better
Vogel & Nunamaker ('88)	Better		Better (implemen- tation achieved)
Nunamaker et al. ('89)	Better (increased with group size)	better (in goal achievement)	Better (commitment generation)
Dennis et al.('90)	Better (shared understanding)	Better	Better
Vogel & Nunamaker ('90)	Better (particularly, larger groups)		Better

and evaluated those options with more criteria in very systematic manner, so the enhanced decision confidence of the GDSS groups over manual groups was observed. These different results may be due to the type of the system being used in each study.

While DECAID and SAMM of the University of Minnesota basically incorporate rational problem-solving agenda [DeSanctis & Dickson, 1987], (Perceptronics' Group Decision Aid) is a multi-attribute utility theory based decision analytic model building system, and it is facilitated by an specially trained system operator [Steeb & Johnston, 1981]. Decision analytic computer support models might considerably increase users' confidence about their decision.

2.3. Field studies

All of the field studies examined here (note that all of them are facilitator-driven GDSS) have shown that GDSS use produces high satisfaction and enhanced decision confidence without regard to prior experience with a GDSS (see table 4).

3. GDSS effects on participation and conflict

Numerous GDSS research [Huber,

1984; DeSanctis & Gallupe, 1987; Vogel et al., 1987] argue that the main goals of a GDSS are to make meetings more productive through improving group communication activities via encouraging equality of participation and increasing the efficiency of that participation.

3.1. Experimental studies

3.1.1. GDSS versus no support treatments

Five studies [Easton, 1988; Easton et al., 1989; George et al., 1988; Kull, 1982; Lewis, 1982] report the enhanced participation of GDSS groups compared to baseline groups. Three studies [Gallupe, 1986; Watson et al., 1988; Jarvenpaa et al., 1988], however, found no difference in participation between two treatments (see table 5).

3.1.2. GDSS versus manual structured treatments

Six studies found the use of a GDSS to increase the participation among members [Bui & Sivasankaran, 1990; Gallupe & McKeen, 1990; Lewis, 1982; Steeb & Johnston, 1981; Zigurs, 1987; Zigurs et al., 1988]. But, three studies showed no difference in participation between GDSS and manually structured groups [Beauclair, 1987; Easton et al., 1989; Watson et al., 1988].

White et al. (1980) reveal that the key effect of structured procedures is to increase member participation. Overall results of comparison between GDSS and baseline groups fairly support this finding. Of greater interest is the finding that much research observes the enhanced participation from the use of a GDSS compared to a manual structured support. Technology (e.g., electronic communication channels, individual assured input, anonymity) clearly acts to increase the participation among members. But, it has a cost. Previous research consistently report the increased conflicts among participants from the use of GDSS compared to manual structured supports [Gallupe et al., 1988; Watson et al., 1988; Zigurs et al., 1988] as well as no support treatments [Gallupe, 1986; Kull, 1982].

3.2. Field studies

As we can see from table 6, previous field multi workstation-based GDSS research (Arizona and others) also consistently report the enhanced participation and increased conflict from the use of the system.

Table 5. Summary of experimental GDSS studies with regard to users' participation and conflict

	Equal participation	Conflict	Consensus
University of Minnesota			
Gallupe ('86)	GDSS=NS	Increased w/GDSS	
Zigurs ('87)	GDSS>MS		
Watson et al. ('88)	GDSS=MS=NS.	Structure positively manages conflicts	No dif.
Gallupe et al. ('88)		Increased w/GDSS (but, not destructive)	GDSS worse than MSS
Zigurs et al. ('88)	GDSS>MS	Increased w/GDSS	
Gallupe & McKeen ('90)	GDSS>MSS		
University of Arizona			
George et al.('88)	GDSS>NS		No dif.
Easton, G. ('88)	GDSS>NS		GDSS worse than NS
Easton et al.('89)	(GDSS=MS)>NS		
Others			
Kull ('82)	GDSS>NS (due to personal assured input terminal)	Increased w/GDSS (due to public display of voting and need to explain one's position)	GDSS worse than NS
Lewis ('82)	GDSS>MS,NS		
Beauclair ('87)	GDSS=MS		
Steeb & Johnston ('81)	GDSS better (due to individual assured input)		GDSS better
Bui & Sivasankaran ('90)	GDSS>MSS (also, reduce the influence of dominant members)		
Jarvenpaa et al.('88)	EWS=NS		

* MS: manual structured process (same degree of structure with a GDSS)
MSS: manual semi-structured process (loosened structure than a GDSS)
NS: no structured support at all
EWS: electronic workstation

Table 6. Summary of GDSS studies in real world settings with regard to participation and conflict

	Equal participation	Conflicts	Consensus
Decision Conferencing			
Weiss & Zwahlen ('82)	GDSS better	GDSS better (sense of closure)	GDSS better (unified understanding of entire issues)
Adelman ('84)			GDSS better
Phillips ('85)	GDSS better		GDSS better (incorporate the differing perspectives of the members in the group)
Phillips ('86)			GDSS better (shared understanding of the issues)
Volpato ('89)			GDSS better
Plexsys System at University of Arizona			
Nunamaker et al. ('87)	GDSS better (due to anonymity: domination decreased)	GDSS worse	
Vogel et al. ('87)	GDSS better (anonymity)	GDSS worse	
Nunamaker et al. ('88)	GDSS better (domination decreased wth anonymity)	GDSS worse (due to anonymity)	GDSS better (sharing of group vision is achieved through much negotation)
Vogel & Nunamaker ('88)			GDSS better
Nunamaker et al. ('89)	GDSS better		
Dennis et al.('90)	GDSS better		GDSS better (stronger agreement)
Vogel & Nunamaker ('90)	GDSS better (due to voting & anonymity)	Increased as well as decreased with GDSS	
Others			
Gibson & Ludl ('88)	GDSS better (due to Idea Dialog Mode)	GDSS worse (more inhibition and politics rather than openness and trust)	
Zigurs et al. ('89')	GDSS better	GDSS worse	

Researchers explain the enhanced participation among members as due to the individual workstation. Many multi workstation GDSS researchers [Nunamaker et al., 1988; 1989; Siegel et al., 1986] claim that an individual workstation provides a framework within which group members who are reluctant to contribute are encouraged to participate and potentially influence the group discussion. Arizona researchers have continuously found the anonymity of electr- onic communication to increase the number of interpersonal exchanges and reduce the probability of any one member dominating the meeting. However, anonymity function inherent in multi workstation GDSS was found to heighten conflict within the group as members tend to become mor aggressively communicate each other: members tend to express themselves more forcefully and are often not as polite when interfacing through the system rather than in person [Kiesler, 1986; Siegel et al., 1986; Vogel & Nunamaker, 1987; Jarvenpaa et al., 1988; Nunamaker et al., 1988; Watson et al., 1988].

Other researchers also found that the use of electronic media (here, public display and multi workstation) reduced the social cues and social interaction of a meeting, therefore increased conflicts [Turoff and Hiltz, 1982; Kull, 1982; Kiesler et al., 1984; Gallupe, 1985; DeSanctis and Gallupe, 1987; Gallupe et al., 1988; and Watson et al., 1988].

However, field studies of a single-workstation based GDSS (here, a decision Conferencing) in table 6 have consistently found the enhanced participation and consensus from the use of the technology [Adelman, 1984; Phillips, 1985;1986; Volpato, 1990; Weiss & Zwahlen, 1982].

Ⅲ. Factors for Different Results in GDSS Research

Many authors have suggested various clues for the inconsistent findings in previous GDSS research [Dennis et al., 1988; 1989; Gallupe, 1986; Jarvenpaa et al., 1988; Nunamaker et al., 1988;1989; Phillips 1989b; Pinsonneault & Kraemer, 1989; Sharda et al., 1988; Valacich et al., 1989; Van Schaik & Sol, 1990; Vogel et al., 1987;1990]. However, the present review of previous research makes us to suggest that different results occur mainly due to the differences in contextual pressures, tasks, group characteristics, GDSS configurations, and measures employed and degree of control for the experiments. Of course there is also a need to recognize

the importance of multidirectionally interacting relationships between these variables.

1. Contextual pressures

Decision makers in actual organizational settings may be subject to a variety of pressures and constraints not easily investigated in laboratory settings. O'Reilly et al. (1987) argue that in order to understand how information is used and decisions are made by real-world decision makers, studies need to account for the contextual pressures that affect decision makers' willingness and ability to search for and use information in the actual performance of their duties. This is an important consideration since a number of studies [Beach, 1975; Ebbesen & Kocnecni, 1975; Svenson, 1979] suggest that decisions made under the artificiality of the laboratory situations may not correspond with the same decisions made in living world.

O'Reilly et al. (1987) suggest three factors of contextual pressures, which can be seen in the form of reward and punishment systems, hierarchy and authority, coordination and control, and others, all having the result of securing conformity and compliance from organizational participants:

i) incentive systems, which act to encourage the pursuit of certain goals and discourage others;
ii) organizational structure, which acts to restrict and channel information flows and establish a system of roles, authority, and expertise; and
iii) group pressures (norms), which are both formal and informal and which make salient desired attitudes and behaviors.

O'Reilly et al. (1987) concluded that unless these contextual or situational influences on decision makers' propensities to seek out and use information are investigated, findings about information processing and decision-making behavior may not possess the external validity to be useful in understanding organizational decision-making. This conclusion can be exactly applied to the GDSS study.

In the previous research review, we saw that experimental GDSS studies reported inconsistent findings with regard to decision quality. We also saw that experimental GDSS groups usually took longer time in arriving their decisions than manually

Table 7. Differences in information cues between laboratory and field GDSS studies (Adapted from O'Reilly et al., 1987)

In laboratory studies, the information cues typically:	In field studies, the information cues typically:
- are provided to participants in case	- are often difficult to distinguish, available but not easily accessed
- are obtrusive and reactive	- are unobtrusive and nonreactive
- are written	- are verbal
- are relevant only to the set of tasks at hand; the experiment creates its own context	- are relevant to a broad set of tasks
- emanate from a "neutral" source with which the subject is unfamiliar	- come from a wide variety of frgmented sources of varying degrees of objectivity and accuracy
- are not verifiable through feedback	- can be checked for accuracy
- are limited in the number of cues which are methodologically feasible in any one study - have no interpersonal content	- are interpersonally, socially, culturally, and sequentially embedded

structured process support or baseline groups. However, most field studies reported that participants experience the improved decision quality and efficiency from the initial use of a GDSS compared to a similar conventional meeting, without regard to the differences in system design (whether it is a facilitator-driven or a user-driven; a single workstation-based or a multiple workstation-based GDSS). Therefore, contextual pressures may be one of the important reasons for the differences in the findings between experimental and field GDSS studies. GDSS do not exist apart from the group and organizational contexts or the external environment of organizations Table 7 highlights some of the more important distinctions in information management needs of users between laboratory and field studies used in GDSS research.

2. Tasks

Virtually all group researchers agree that group performance cannot be studied generically without regard to task, and that an individuals' performance is without question affected by the type and characteristics of the task [McGrath 1984; Poole 1983]. In some research, the nature of the task has accounted for as much as 50% of the variance in group performance [Poole et al., 1985]. Task determines the need for information and the consequent communication practices of the decision-making group. Therefore, task differences in GDSS research can have a major impact

on the research results.

GDSS researchers have attempted to investigate the effect of tasks on how computer support is viewed and used. Here, we examine the effects of task differences on GDSS results based on type of task, degree of task complexity, structure of task, and task characteristics inherent in each decision-making phase).

2.1. Type of tasks: hypothetical versus real

One of the important factors which distinguisih hypothetical tasks to real ones may be the degree of stimulation to participants. Participants in case and field GDSS studies are working on solving their own on-going problems instead of problems assigned to them by researchers. They usually have their own stake in the task. It is simply impossible to find tasks for experiments that can so stimulate participants as do real tasks. The degree of desire (or responsibility) to solve their own problems or fictitious ones can make a difference in the extent of a GDSS use and the perception of GDSS use. Type of task may be one of the important variables to explain the contradictory results between field and experimental GDSS studies.

2.2. Task difficulties

A number of researchers in group decision-making have shown that task difficulty is a major factor that affects group performance in terms of outcome quality and group process [Fisher, 1981; Roby & Lanzetta, 1958; Shaw, 1973]. There is much evidence that using a GDSS for problems of low complexity is not worthwhile due to the "overhead cost" involved in using the sophisticated tool [Bui et al., 1987; Dennis et al., 1988; Gallupe & McKeen, 1990; Jarvenpaa et al., 1988; Zigurs et al., 1988]. Some experimental research [Bui & Sivasankaran, 1990; Gallupe, 1986; Gallupe et al., 1988] has shown that decision quality was particularly improved with a GDSS use for more complex problems. Most field GDSS studies report the improved decision quality and efficiency of the decision-making process from the use of a GDSS compared to a similar conventional meeting.

While hypothetical tasks in experimental studies are usually isolated from the external world (the experiment creates its own context, and all necessary information is provided to participants in case packages), real tasks are socially, culturally, interpersonally, and sequentially interrelated with other problems. It means that the

complexity of experimental tasks is far below the complexity of tasks faced by business groups.

Thus, it seems clear that the task difficulty is one of the important variables to explain the contradictory results between GDSS studies, especially laboratory and field ones.

2.3. Structure of tasks: right or wrong answers versus better or worse answers

The other important difference in the tasks between the experimental and field GDSS studies is whether they have right or wrong answers, or better or worse answers. To measure the effectiveness of a system in a limited short time period, laboratory GDSS research generally uses the task with right or wrong answers for their experiments. Subjects (mostly students) in the experiments also share similar perspectives and data on the task each other. However, the nature of the ill-structured tasks in real world precludes knowing a "correct" solution. As Mason and Mitroff (1983) commented, for ill-structured problems there is no criterion to determine a solution correct or false: solutions are at best judged as good, bad, reasonable, but never correct or false. Watson et al. (1988) also argue that many organizational meetings occur without prior or post knowledge of the "correct" outcome of a group meeting. Managers also bring a different set of relevant data and their own role-defined perspective on the issues. In such situations, groups must often resolve competing personal preferences and maximize agreement on a solution to a problem. Then, it is not surprising to notice the different results between experimental and field research.

2.4. Task characteristics inherent in each decision making phase

Some researchers [Lyles, 1981; Mintzberg et al., 1976; Pounds, 1969] have described the decision process as involving a number of distinct phases (such as issue diagnosis, solution generation, consensus reaching, and choice)-that at any one point in the decision process, a particular type of decisional activity dominates all the others, and that decision-makers' attention is focused on one phase at a time.

Based on this phase associated decision-making assumption, researchers mainly from the University of Minnesota have investigated the effect of GDSS use on the group performance by varying the task characteristics inherent in each decision making phase(see table 8, 9, and 10).

Table 8. Categorisation of experimental GDSS research based on task characteristics in each decision-making phase(the University of Minnesota)

	Decision quality	Satisfaction with process
PROBLEM FINDING (ISSUE DIAGNOSIS) TASK		
Gallupe ('86) Gallupe et al. ('88)	GDSS>NS GDSS>MSS	GDSS<NS GDSS<MSS
CONSENSUS REACHING TASK		
Gallupe ('90) Gallupe and McKeen ('90) Watson et al. ('88)	GDSS=MSS GDSS=MSS GDSS<MS,NS (but, overall performance: GDSS=MS>NS)	GDSS<MSS GDSS<MSS GDSS<NS<MS
CHOICE TASK		
Zigurs et al. ('88)	GDSS=MS (but, overall performance: GDSS=NS>MS)	GDSS>MS

* MS: manual structured process (same degree of structure with a GDSS)
MSS: manual semi-structured process (loosened structure than a GDSS)
NS: no structured support at all

Table 9. Categorisation of experimental GDSS research based on task characteristics in each decision-making phase(Others)

	Decision quality	Satisfaction with process
IDEA GENERATION TASK		
Lewis ('82)	GDSS>MS,NS	GDSS>MS,NS
CONSENSUS REACHING TASK		
Beauclair ('87) Jarvenpaa et al. ('88)	GDSS=MS EBB>EWS>NS (but, overall performance: EBB>EWS>NS)	 EWS=NS
CHOICE TASK		
Bui et al. ('87)	GDSS=MS	

* MS: manual structured process (same degree of structure with a GDSS)
MSS: manual semi-structured process (loosened structure than a GDSS)
NS: no structured support at all
EBB: electronic blackboard
EWS: electronic workstation

Table 8 categorizes the research findings of the University of Minnesota according to the task characteristics in each decision-making phase. As we can see from table 8, in problem finding tasks, GDSS groups show enhanced decision quality, but increased dissatisfaction with the process over manual or no support groups. In consensus-reaching tasks, while two studies [Gallupe, 1990; Gallupe & McKeen, 1990] show no difference in decision quality between GDSS and manually structured groups, one study [Watson et al., 1988] shows decreased decision quality in GDSS groups compared to manual structured or baseline groups due to the technical intru-

Table 10. Task characteristics used in experimental GDSS research

RESEARCHER (S)	TASK
	PROBLEM FINDING (ISSUE DIAGNOSIS) TASK
Gallupe ('86)	"Bonanza Business Case" (A firm is losing profits at the same time sales are rising.)
Gallupe et al. ('88)	Revised "Bonanza Business Case"
	IDEA GENERATION TASK
Lewis ('82)	Severe financial problems in a university
	CONSENSUS REACHING TASK
Gallupe ('90)	Modified "Bonanza Business Case" (set priority for competing projects under limited funds)
Gallupe and McKeen ('90)	Modified "Bonanza Business Case" (find out and agree with the cause of company's problem by rank choice)
Watson et al. ('88)	Resolving conflicts of personal preference in money allocation
Beauclair ('87)	Policy formation for student misconduct at a university (find out and reach agreement)
Jarvenpaa et al. ('88)	Unstructured, high-level conceptual software design (find out and reach agreement)
	CHOICE TASK
Zigurs et al. ('88)	Choosing from an applicant pool: alternatives and criteria were known.
Bui et al. ('87)	Selecting a regional director from an applicant pool

sion problem. But, all of them report the less satisfaction with the GDSS use compared to manual or baseline treatments. Inchoice tasks, GDSS groups show no advantage in decision quality over manual groups, but their degree of satisfaction with the process is relatively higher than manual groups. Minnesota resesrchers have explained the mixed results of their experimental studies by the particular task characteristics inherent in each phase of decision-making process. According to Zigurs et al. (1988), the effectiveness of a group's adaptation of support technology is partially a function of the match between the group's view of task demands and its view of the technology.

That is, the key to significant effectiveness increases in computer support of groups may be in both the adaptability of the system to the task and the adaptability of the group in their view of the system's utility and meaning. In short, one particular type of GDSS may be more effective in dealing with one particular type of task rather than the others.

Can these interpretations be generalized to other settings (e.g., different GDSS facilities)? Table 9 may give a partial answer to this question. As we can see in table 9, the results of other research show a somewhat different picture from the Minnesota study. Lewis (1982) showed enhanced decision quality and satisfaction with the process of GDSS groups over manual or no support groups in the idea generation task. In a consensus-reaching task, Jarvenpaa et al. (1988) found enhanced decision quality in GDSS groups over baseline groups, but no difference in

satisfaction with the process between two groups. Unlike the negative reactions of GDSS use reported in most Minnesota research, Jarvenpaa et al.(1988) report that the participants largely agreed that a GDSS (electronic communication media) was interesting and held promise irrespective of its technical immaturity which caused cognitive overload to participants.

The findings from the field studies also show a somewhat different picture from the Minnesota study. As we saw in the previous research review, most case and field studies reported the improved decision quality, efficiency, and satisfaction from the use of a GDSS compared to a similar conventional meeting. Unlike the experimental issues, real world issues always require managers to exercise all of the major task characteristics inherent in each decision-making phase (information gathering, alternatives development, alternative evaluation, consensus reaching, and alternative selection) together.

3. Group characteristics

Individuals usually belong to many types of groups, but groups are not just any aggregation of two or more people. Although there are many ways of classifying groups, depending on a person's perspective (e.g., see Shaw, 1981), most existing definitions, however, stress the ideas of common perception, common goal, interdependence and interaction, history, size, and organizational structure (particular norms and procedures in a certain group). Here, we examine group differences as one explanation for the different GDSS research results.

3.1.Subjects: students versus business professionals

Many of the past experimental GDSS studies used groups of students formed solely to address a task created for an experiment. Experimental groups were not created because they had the desire to solve a particular problem but to conduct an experiment [Nunamaker et al., 1988].

Therefore, they rarely have a vested interest and responsibility in the outcome of the studies and are likely to be less enthusiastic than field study groups [Nunamaker et al., 1989; Tetlock, 1985]. The implication is that the effectiveness of a GDSS may become more apparent when it deals with diverse opinions of group members.

The other possible reason for the different results between field and laboratory

Table 11. Differences between laboratory and field studies(O'Reilly et al., 1987)

In laboratory studies, the decision makers usually:	In field studies, the decision makers usually:
- are passive receivers	- are senders as often as receivers
- are focused on a limited set of cues	- are concerned with multiple ones
- have little experience with the task	- are well experienced with the task
- have little vested interest in the long term except for the one set by experimenter	- have potentially conflicting goals
- operate with artificial time pressures	- operate with a variety of time pressures
- have little vested interest in long term results	- are responsible for long term results
- are clearly identified	- are often unidentified
- are unconcerned with interpersonal relationships	- must deal with interpersonal as well as task relationships

research may be the subject's ability to compare GDSS use with a conventional method. Some studies [Dennis et al., 1988; Nunamaker et al., 1989] point out that it is extremely difficult to measure differences in satisfaction unless groups have experienced both conventional and automated support for equivalent tasks. Whereas subjects in field studies are quite familiar with an equivalent manual process, those experiencing the automated support in laboratory settings may lack the ability of real world users to compare GDSS use with conventional means of accomplishing the same tasks.

Table 11 highlights some of the more important distinctions in the subjects between laboratory and field GDSS studies [O'Reilly, 1987]. These differences of the subjects can, in part, clearly explain the different results between field and experimental research. These differences imply that future experimental GDSS research should use real world subjects if results are to have greater external validity.

3.2. Group development stage

Relationships and groups do develop and grow from the early stages of getting acquainted to the mature stages of effective, smooth functioning, and ultimately to stable states and stagnation [Schein, Vol. 1, 1988, p.80].

Group dynamics research [Borman, 1970; McGrath, 1984] have pointed out the drawbacks of using zero-history groups to study group behavior and the inconsistent findings that may result. GDSS researchers [Bui et al., 1987; Dennis et al., 1989; Fedorowicz, 1986; Kiesler, 1986; Watson et al., 1988; Zigurs, 1987] also point out the importance of using groups with a meaningful history and future. However, most laboratory GDSS

studies have examined the effect of computer support during the first (and in fact the only) meeting of ad hoc groups [Chidambaram et al., 1990]. Although it is difficult to pinpoint the developmental stage of a group at any specific time, the group development model at least implies that newly formed groups can show quite different behavior patterns from mature ones. So, GDSS research results may be also affected by the stage of development of a group used in the study. In fact, Dennis et al. (1990) show that there are differences between established and ad hoc groups. Established groups are less afraid to be openly critical of their peers or of being impolite.

In their assessment of existing empirical GDSS research, Pinsonneault and Kraemer (1989) argue that an automated support might have significant effects on groups at the early stages of development where group members try to establish and understand the norms of the group, try to define and defend their position, and try to obtain a basis of influence over the decision process, because it permits the members to focus more rapidly and intensely on the task itself, or, in other words, to arrive at a functional stage faster than those not supported. They, then, expect that the benefits of an automated support increasing task-oriented communication and clarification efforts might be minimal at the more advanced stages of group development, when members have already focused on the task.

As we saw earlier, however, the results of most field studies do not confirm this expectation. Although there were ad hoc groups in field GDSS research, which were specially formed to address a specific problem, but the vast majority of subjects in field GDSS studies knew each other very well and were used to working together in groups. In other words, they were at the mature stage of group development. But, most field studies have reported the very positive findings from the use of a GDSS compared to a conventional method. Specifically, Vogel and Nunamaker (1987) report that the GDSS can be used successfully both by mature groups where the members are familiar with each other and by groups specially formed to address a specific problem or question. More research is needed to better understand the impacts of the group development factor on the effectiveness of a GDSS in real organization settings.

3.3. Norms

Norms are rules of behavior, proper ways of acting, which have been accepted as appropriate by members of a group. Given a set of goals, norms define the kind ior which is (believed to be) necessary for or consistent with the realization of those goals [Hare, 1976, p.19].

In fact, some GDSS research indicates the impact of norms on their research findings. For example, Jarvenpaa et al. (1988) tested for differences in how each of the three software designer groups used the technology.

They reported significant differences in performance and interaction measures among the groups, which were examined under identical technological supports. Zigurs et al. (1988) observed that the norms of one experimental group was such that it chose not to use the GDSS during the experiment. Dennis et al. (1989) reported that group meetings can become more or less electronic, more or less conventional, depending on the preference of the subjects. Dennis et al. (1990) also showed the great deal of variance in the performance from the use of a GDSS between the established groups, compared to the ad hoc groups. They reckoned this variance as due to the differences in norms among the established groups.

As we examined earlier, real users, compared to the inconsistent findings in experimental GDSS research, were consistently satisfied with the GDSS use. The norms of experimental groups may simply be different from those of business groups.

4. GDSS Configurations

As we reviewed before, the results from previous studies paint a mixed picture of the utility of meeting support technologies. Many researchers [Dennis et al., 1989; George, 1989] have explained the reasons for these mixed results by the differences in how technologies are used across a variety of settings and for tasks. All components of the GDSS environment have been shown to impact the process and outcomes of GDSS research. For example, the facility has an effect on the outcome of meetings [Mantei, 1989], hardware speed is important [Dennis et al., 1989], structured group work procedures show generally positive effects, and the role of group facilitation is also crucial [Dennis et al., 1990; Phillips, 1986;1988].

Literature on the effects of computermediated communication also indicates that the use of technology will change group process. For example, it in-

fluences interpersonal relations, roles, organizational work, job performance, group productivity, and decision-making activities[Bikson, 1983; Chapanis, 1972; Christie, 1981; Hiltz & Turoff, 1981; Kiesler, 1986; Siegel et al., 1986; Turoff & Hiltz, 1982]. So, it is natural to expect that different GDSS technologies can affect meeting outcomes and therefore research findings.

In fact, investigations of GDSS technical environments demonstrate that even within a single GDSS category, decision rooms in this study, there are considerable variations acrosssystems. This is because the developers of each GDSS have their own unique philosophies and visions about what a GDSS is and what it should do. GDSS differ markedly each other in technical variables. The technical variables, here, refer to what features the GDSS provide, what activities those features support, and the extent of support they provide. Jarvenpaa et al. (1988) address the need of more research to be done to determine exactly what features of a GDSS provide the most effective and efficient support for specific types of decision tasks.

5. Measures employed

A caveat also exists in terms of degree of experimental rigor, measurement sophistication, and accountability for confounding effects of the variables [Vogel & Nunamaker, 1990]. Different research design and noncomparability of measures across GDSS studies may also yield different research results.

Ⅳ. Concluding Remarks

The important question posed by this review of prior research is: what are the reasons for the inconsistent results within experimental tests, and especially between field and laboratory research? Nunamaker et al. (1989) caution that the contradictory results between field experiences and many experimental studies are indeed a problem if results of academic research are to be applied effectively in business settings. A research (Jarvenpaa et al., 1988) questions whether a GDSS in face-to-face meetings is simply not functionally advantageous or whether the lack of positive effects from using a GDSS is a result of serious limitations in the existing laboratory research. Our general impression from this review is that it seems to be both.

On the one hand, some technical configu-

rations certainly cause negative effects as well. For example, it becomes clear that conflicts are increased in a mult workstation-based GDSS. Unlike a facilitator-driven GDSS, participants in a user-driven GDSS show less satisfaction with the initial use of the system due to the problems of technical unfamiliarity.

On the other hand, the distinctive difference in the results between field and laboratory research may imply that the real effectiveness of a GDSS can only be recognized when real managers use it to tackle their very live and formidable tasks. Of course, we can not rule out the possibility that the results of field studies may be affected by investigator's subjective optimism: the results were mainly based on anecdotal evidence rather than on rigorous measurement. But, results from all case and field studies reviewed here consistently show the positive effect of a GDSS regardless of different technical configurations, (e.g., one is people-centered, and the other is computer-centered [Phillips, 1988]), softwares, types of a task, and measuring methods employed. However, the positive reponses of real managers are guite relevant, given the maturity of the partiapants and their familiarity with an equivalent conventional process.

Many experimental researchers also explained their discouraging findings as due to the lack of prior experience of users with the system, inappropriateness of the task, immaturity of software, one-time session experiment, etc.

Based on the analysis of previous research, we try to suggest five main factors for the inconsistent findings in GDSS research : contextual pressures, tasks, group characteristics, technical configurations, and comparability of measures. In the meantime, the current study also raises the following issues to be explored.

1. GDSS configurations based at different institutions differ markedly from one setting to another. The designs of the experiments also differ markedly from each other. Therefore, GDSS researchers should be careful about the generalizations of their findings across GDSS studies. All of the findings across systems and across experiments must be interpreted carefully, because the findings are often the answers to different research questions.
2. Many GDSS studies lack the theory associated with their variable choice and hypothetical relationships. A conceptual framework with criteria by

which to judge the effectiveness of a GDSS is needed.

3. The facilitators must try to understand the differences in the culture and style of the organization for they will influence the managers' decision making perspectives.
4. GDSS research should explore its effect on the implementation of a decision. GDSS research so far has concentrated to find out its effect on decision quality, decision time, and user satisfaction. In addition to these variables, GDSS developers should consider how a GDSS can be designed to improve the level of implementation of a definitive decision.

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◇ 저자소개 ◇

공동저자 **전기정**은 상명여자대학교 정보처리학과에 재직중이다. 그는 연세대학교 경제학과를 졸업하고, London School of Economics에서 경 영정보 및 의사결정학 석,박사학위를 취득하였으며 동대학 의사결정분 석 연구소(Decision Analysis Unit)에서 연구원으로 활동하면서 미 국 방성(U.S. Army)의 "의사결정자의 행위연구 및 GDSS효과 분석" 프로 젝트(Contract Number DAJA 45-85-C-0073)에 참여하였다. 현재 한국적 의사결정 유형 모델의 개발과 GDSS의 현장연구를 실시중이다.

공동저자 **박홍국**은 상명여자대학교 정보처리학과에 재직중이다. 그는 서울대학교 경영대학을 졸업하고 동대학원 경영학과를 수료한 후 미국 Claremont 대학의 Peter F. Drucker Management Center에서 경영학 석사 및 경영정보학 박사학위를 취득하였다. 주요 관심분야는 EIS, GDSS, Expert System 등의 의사결정 지원과 정보보호 분야이다.