

參與型與指導型領導者在時間壓力下 對群體支援系統輔助成效之影響

Effects of Participative and Directive Leadership in a GSS-Mediated Environment under Time Pressure

洪新原¹ Shin-Yuan Hung

國立中正大學 資訊管理研究所

Department of Information Management, National Chung Cheng University

康贊清 Tsan-Ching Kang

國立中正大學 資訊管理研究所

Department of Information Management, National Chung Cheng University

黃立雙 Li-Shuang Huang

國立中正大學 資訊管理研究所

Department of Information Management, National Chung Cheng University

黃心怡 Hsin-Yi Huang

國立中央大學 資訊管理研究所

Department of Information Management, National Central University

摘要：會議中領導者展現的領導風格與會議進行的時間，往往對會議績效有顯著的影響，強勢的領導風格與緊湊的會議時間各有優缺點，而多數研究也指出，群體支援系統可以顯著改善會議績效，因此本研究想探討在群體支援系統的環境中，有無時間壓力與不同領導風格下的會議是否會有不同的決策結果，以進一步瞭解群體支援系統的應用對於會議績效的影響。本研究將領導者型態分為參與型與指導型，分別在有時間壓力或無時間壓力下，利用群體支援系統完成任務，以探討對決策產出之影響。採用實驗室實驗法，以二因子完全隨機設計進行同時且面對面的實驗。研究結果發現：(1)有無時間壓力，對方案產生數、單位構想產生數、決策過程滿意度有顯著影響。沒有時

¹ Corresponding author: Department of Information Management, National Chung Cheng University, Chiayi County, Taiwan, E-mail: syhung@mis.ccu.edu.tw

間壓力的組別有較多的方案產生數與單位構想產生數，也有較高的決策過程滿意度；(2)不同領導者型態，對決策績效有顯著影響。參與型領導者所領導的群體比指導型領導的群體有較佳的群體決策績效；(3)時間壓力與領導者型態的交互作用會影響決策結果。在有時間壓力下，參與型領導者領導的群體比指導型領導者領導的群體有較多的單位構想產生數。

關鍵詞：群體支援系統；群體決策；領導者型態；時間壓力

Abstract: Previous studies did not precisely examine the effects of leadership style in Group Support System (GSS) meetings. Decision makers in organizations also face time pressure frequently. Thus, this study aims to examine the effects of leadership style and time pressure on group interaction and decision outcomes. A 2*2 factorial design experiment was conducted. Sixty groups participated in the experiment. "Personal Trust Foundation" was adapted as the decision task. The manipulated variables were leadership styles (participative or directive) and time pressure (under or without). The dependent variables include equality of participation, GSS process satisfaction, number of solutions, number of solutions per minute, perceived decision quality, and GSS outcome satisfaction. Results indicate that: (1) Leadership style has significant effects on group decision making. Groups with participative leaders outperform those with directive leaders; (2) Groups under time pressure generate both less solutions and solutions per minute, and perceive lower GSS process satisfaction; (3) Under time pressure, groups with participative leaders generate more solutions per minute than those with directive leaders.

Keywords: Group support system; Group decision making; Leadership style; Time pressure

1. Introduction

Group Support System (GSS) has been proven to improve decision performance significantly. It decreases peer group pressure, fear of evaluation from others and authority, and increases cooperation within groups (Nunamaker

et al., 1991). However, other studies indicate that GSS can decrease decision performance as well. For example, GSS can decrease perceived decision quality (Straus and McGrath, 1994), the number of opinions (Straus and McGrath, 1994), and personal satisfaction (Gallupe *et al.*, 1992) and can increase decision time (George *et al.*, 1990). Therefore, finding factors affecting GSS performance may help to explain the inconsistent results and clarify the relationship between GSS and decision quality.

Group leaders usually have decisive impacts in group decisions, but past studies of GSS did not manipulate or measure leadership styles. These studies were selected at random. Thus, how leaders behave and the process of how leaders motivate interaction among members remain unclear (Sosik *et al.*, 1997). The impact of leaders on the meeting outcomes is inconclusive (Bass, 1990; Janis, 1982; Johnson and Bechler, 1998; Neck and Moorhead, 1995; Nunamaker *et al.*, 1997; Sosik *et al.*, 1997; Suutari, 1996). Consequently, this study tries to manipulate leadership styles, which include participative leadership and directive leadership, and tests their impacts on group decisions.

On the other hand, decisions in corporations and organizations usually have to be done in limited time (Ordonez and Benson III, 1997). Individuals and groups, such as airline clerks, organizational teams, and medical teams, have to make decisions under time pressure in different kinds of situations (Brown and Miller, 2000; Svenson *et al.*, 1990). However, only two GSS papers out of 200 GSS-related papers from 1970 to 1998 discussed the impact of time pressure (Fjermestad and Hiltz, 1998). Whether the negative impacts of time pressure can be decreased in a GSS environment needs to be investigated. Specifically, this research seeks to answer the following questions:

1. Under a GSS environment, does time pressure affect the performance of group decisions?
2. Under a GSS environment, does leadership style affect the performance of group decision?
3. Under a GSS environment, does interaction between time pressure and leadership style affect the performance of group decision?

A Lab experiment and a preference task discussion “Personal Trust Foundation” were used in this study (see Watson *et al.*, 1988). The evaluation of group decisions includes the number of solutions, the number of solutions per minute, decision quality, satisfaction with the decision process, and equality of participation. The next session presents a literature review on GSS, leadership style, and time pressure. Session 3 presents the research methods, and session 4 describes data analyses and discussions. Finally, the conclusions, limitations and future research are discussed in session 5.

2. Literature Review

2.1. Group Support System

Group Support System (GSS) is an information system used for forming questions, finding solutions, and supporting the process of meeting (Huber 1984). GSS has four benefits for group meeting: parallel communication, group memory, anonymity, media effect, and collaboration (Bostrom *et al.*, 1993; Nunamaker *et al.*, 1991). Parallel communication allows individuals to talk and exchange opinions at the same time. Anonymity helps individuals express personal preferences, ideas, and votes anonymously. Group memory stores the record of group meeting. Collaboration indicates that GSS can support the interaction among group, task, and technology. Media effect explains the differences between GSS and mass media, such as the decrease in personalization, media richness, and information view. Four GSS mechanisms explain why GSS can support group meeting: process support, process structure, task support, and task structure (Nunamaker *et al.*, 1991). Process support is the communication structure that facilitates communication among members. Process structure is the group interaction technology that guides the form and time of discussion. Task support means that the information and computing capabilities of GSS can facilitate the progress of tasks. Task structure implies that GSS provides different technologies, rules, and models in delivering task-related information. Through the four

mechanisms, researchers can understand how GSS increase process gains and decrease process loss. In recent years, the performance of brainstorming in GSS (Chen *et al.*, 2007; Kunifuji and Kato, 2007), and the impacts of GSS on group decision (Haseman *et al.*, 2005; Limayem *et al.*, 2006; Srite *et al.*, 2007) have been investigated.

2.2. Time Pressure

Time pressure is usually treated as one source of pressure (Brown and Miller, 2000). Generally, the decision process under time pressure may be different when there is no time pressure. Under time pressure, the decision process exhibits three changes. First, decision makers can accelerate the process of decisions (Benson and Beach, 1996; Chu and Spires, 2001; Karau and Kelly, 1992; Kelly and Karau, 1999; Verplanken, 1993). Second, decision makers can make decisions based on current information and ignore other information that they cannot reach at that time. This is called filtering (Chu and Spires, 2001; Svenson *et al.*, 1990). Third, decision makers can choose a simpler decision strategy (Chu and Spires, 2001; Ordonez and Benson III, 1997).

Making decisions under time pressure is part of our daily lives (Ordonez and Benson III, 1997; Svenson and Maule, 1993). Time pressure also influences the process of group interaction and group performance (Adelman *et al.*, 2004; Goodie and Crooks, 2004; Karau and Kelly, 1992; Payne *et al.*, 1988; Stuhlmacher *et al.*, 1998; Svenson and Maule, 1993). Time pressure may drive group members to think in the same way, cooperate with each other, and agree with current solutions (Stuhlmacher *et al.*, 1998). It also increases unequal participation during discussions among group members and obedience to opinions of authorities (Driskell and Salas, 1991; Kelly and McGrath, 1985). Many studies indicate that time pressure has negative effects on decision performances (Chu and Spires, 2001; Karau and Kelly, 1992; Ordonez and Benson III, 1997; Svenson and Maule, 1993; Verplanken, 1993). However, few studies discussed the impacts of time pressure on GSS environment. Only two GSS papers out of 200 GSS-related papers from 1970 to 1998 discussed the impacts of time pressure (Fjermestad and Hiltz, 1998). The interaction between time pressure and GSS

may prevent decision quality from decreasing when time pressure decreases decision quality (Smith and Hayne, 1997).

2.3. Leadership Style

Leaders play an important role in group behavior. Past researches discuss the impacts of leaders from transactional perspective, which sets goals, provides feedback, and shares benefits to motivate employees. Both Management Grid Theory and Path-Goal Theory are in transactional perspective (Blake and Mouton, 1964; Halpin and Winer, 1957; House, 1971). However, these theories assume that employees and employers are opposites. Leaders must deal with the conflicts between employees and organizations, and determine satisfactory solutions for both. Recently researches have focused on finding a way to dissolve the conflicts between employees and organizations. Transformational leaders allow employees to feel confident and respected. These leaders guide employees in matching personal goals with organizational goals, allowing them to want to achieve organizational goals (Bass and Avolio, 1994).

In the Path-Goal Theory, both participative leadership and directive leadership have high correlations with group performance (Sosik *et al.*, 1997). Leaders of participative leadership encourage discussion among group members. The ideas of all group members are considered and discussed. However, because the integration of all ideas needs time, decision quality may not be satisfactory under time pressure (House, 1971). Leaders of directive leadership have a clear vision of their expectation, their goal of completing the task, and the job assignment of each member. They usually tell group members their preferred ideas and ask members to follow their ideas. Consequently, they obtain quick solutions. However, in this kind of leadership style, groupthink usually occurs and the number of solutions is fewer than in participative leadership. Different leadership styles may change the decision process and the quality of decisions. Leaders of open leadership style encourage members to exchange ideas and to acquire better solutions. Leaders of closed leadership style make decisions quickly but often reduce the number of ideas (Flowers, 1977). Different leadership styles are appropriate for specific industry environments, but different cultures also

moderate group behavior (Euwema *et al.*, 2007; Hmieleski and Ensley, 2007).

Leaders still play an important role in GSS meetings. GSS cannot replace the role of leaders in group meetings (Nunamaker *et al.*, 1997). The functions of GSS focus on facilitating the process of meetings, and leaders guide members to come up with conclusions from the meetings (Suutari, 1996). As a result, leaders of different leadership styles affect the performance of group meetings (Kayworth and Leidner, 2001; Kotlyar and Karakowsky, 2006; Pavitt *et al.*, 2007; Roussin, 2008; Srivastava *et al.*, 2006). Thus, this study tries to discuss whether GSS can support both participative and directive leadership styles while maintaining decision quality and members' satisfaction under time pressure.

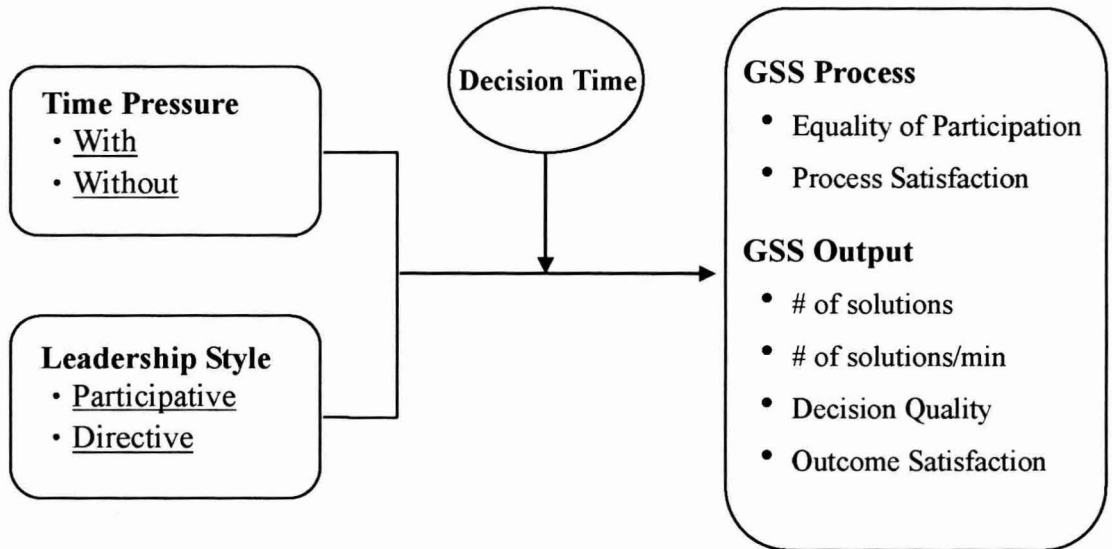
3. Research Method

3.1. Research Framework and Independent Variables

This research adopted a two-factor randomized experiment design. The independent variables were leadership styles (participative leadership and directive leadership) and time pressure (time pressure and no time pressure). The experiment included four cells: (1) leaders of participative leadership under time pressure; (2) leaders of directive leadership under time pressure; (3) leaders of participative leadership under no time pressure; (4) and leaders of directive leadership under no time pressure. Each cell had to collect 15 sets of data. The research framework is shown in Figure 1.

Leaders are more persuasive to group members if they are not assigned by others but are recognized by group members (Johnson and Bechler, 1998). Thus, leaders in this research were voted by group members after the groups completed an a priori task. Leaders were trained to become either participative or directive. Leaders were asked to keep their training process secret. To encourage leaders to behave in an appropriate leadership style, this study gave them money as a token of thanks. The training process followed the steps listed in Larson *et al.* (1998).

Figure 1
Research Model



3.1.1 Participative Leaders

Participative leaders would ask the ideas of each group member first and then share their own ideas. Five minutes prior to the meetings, participative leaders would stress the importance of coming up with the conclusions through a second discussion. When participative leaders found that the opinions converged, they would encourage opposite opinions and even ask some members to criticize these opinions. When the groups came up with the conclusions, participative leaders would ask each group member twice if he/she was not satisfied or if he/she doubted the conclusions.

3.1.2 Directive Leaders

Directive leaders would control the process of the meetings and would be the first one to say which solutions were better. Five minutes prior to the meetings, participative leaders would stress the importance of coming up with the conclusions through a second discussion. During the meeting, directive leaders

would deal with opposite opinions from other members.

Three items were measured to understand whether the manipulation of leadership styles was successful (Larson *et al.*, 1998; Sosik *et al.*, 1997). These items are described in the first three questions in Appendix A. If the manipulation was insignificant for one group of data, such group of data would be discarded.

The manipulation of time pressure followed the steps described in Brown and Miller (2000), and Benson and Beach (1996). An experiment with no time pressure was first carried out to measure the average time and the standard deviation of completing a task. This study set the average time minus a standard deviation as the time limit of time pressure. The experiment with time pressure had to complete the task before the time limit. To understand if the manipulation of time pressure was successful, four items from Brown and Miller (2000), Karau and Kelly (1992), and Karau and Kelly (1999) were measured. Detailed items are described in Appendix A from the fourth to the seventh question. Experiments with no time pressure showed that the average time of completing a task was 41.0987 minutes, and the standard deviation was 13.3613 minutes. Thus, 28.14 minutes was used as the time limit of time pressure. The manipulation process of time pressure is shown in Figure 2.

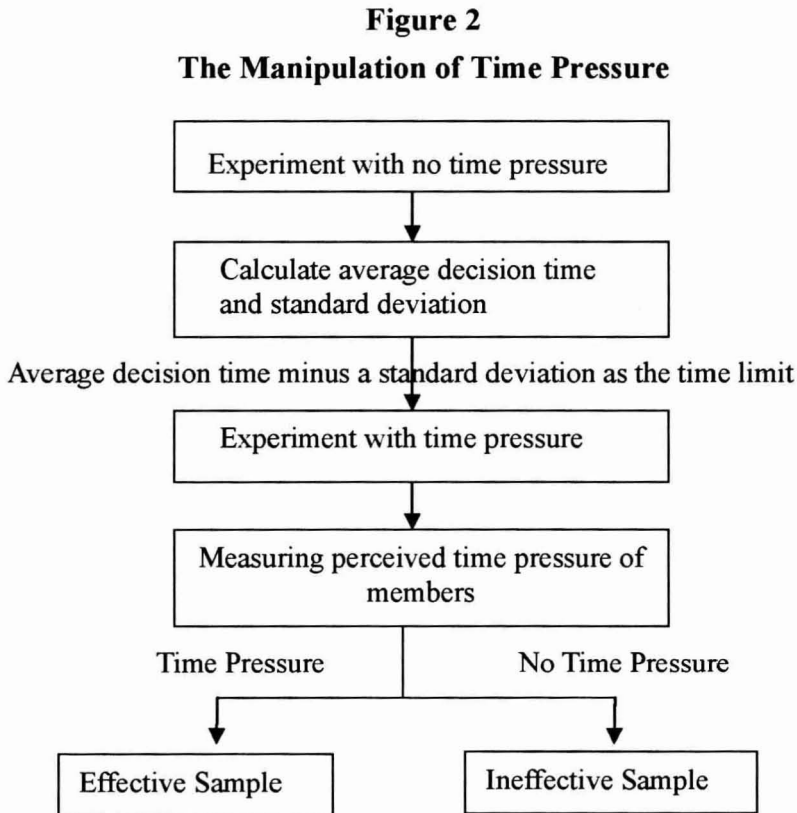
3.2 Dependent Variables

Dependent variables are classified into two groups. One group measures the GSS process, which includes equality of participation and process satisfaction. Equality of participation measures the level of participation among group members (Jarvenpaa *et al.*, 1988). First of all, the number of ideas for each group was summed, and then the variance of the group is calculated to obtain equality of participation for the group. Its formula is described in Formula (1).

$$\frac{1}{\mu} \times \sqrt{\frac{\sum_{i=1}^n (X_i - \mu)^2}{n}} \quad (1)$$

μ is the average number of ideas for each group. X_i is the number of ideas provided by i and n is the number of group members. The lower the value, the

better is the equality of participation. Process satisfaction is one of the key indicators measuring group performances (Green and Taber, 1980; Hwang and Guynes, 1994). Five items were measured based on Green and Taber (1980).



Detailed questionnaires are described in the eighth question in Appendix A. The lowest score was five points, and the highest score was 35 points. The higher the score, the higher is the process satisfaction.

The other group measures the GSS output, which includes the number of solutions, the number of solutions per minute, decision quality, and outcome satisfaction. The number of solutions is the summation of non-repeated solutions for each group member, and it can be obtained through the logs of GSS. It is evaluated and calculated independently by two individuals. The solutions must be both complete and relevant to the task. When the two individuals evaluating the

solutions have different criteria for one solution, the solution is judged by a third individual. The number of solutions per minute is calculated with the number of solutions divided by decision time. Decision quality was measured by eight items based on Gouran *et al.* (1978). The score ranged from 8 points to 56 points. The higher the score, the better is the decision quality. Detailed questions are described in the 9th question to the 16th question in Appendix A. Outcome satisfaction is the degree of acceptance of the discussion results of group meetings. The higher the acceptance of discussion results, the higher is the outcome satisfaction. Five items based on Green and Taber (1980) were used to measure the outcome satisfaction. The detailed questionnaires are described in the 17th question to the 21st question in Appendix A.

3.3 Control Variables and Random Variables

Control variables included Task Type (Personal Trust Foundation (Watson *et al.*, 1988)) and experimental environment (GSS). Group history and computer literacy were randomized because they were not traceable and measurable.

3.4 Covariates

This study used decision time as a covariate. Decision time is the duration from the start of meeting to the end of group consensus. Decision time can moderate the relationship between the independent and dependent variables. When decision time is longer than normal, the dependent variables changed as well. Thus, it was included as a covariate.

3.5 Samples and Task

This study used a two-factor randomized experiment design. This study was pilot tested on 12 students, and some experimental processes were revised accordingly. Each experiment cell had 15 groups. Three subjects were randomly assigned to each group. Thus, 180 participants were recruited to attend this study. Each participant was given about NTD 100 as incentive. As the task was a preference task, it depends on personal values no specific knowledge and skills were required.

The experimental task, Personal Trust Foundation (Watson *et al.*, 1988), assumed that a certain Personal Trust Foundation had a fund of NTD 30 million. Each group assigned the fund to applicants who had scholarly, economic, artistic, social, political, and religious purposes. The proposals of the six applicants were: (1) to renew computer systems at the county government to improve administration efficiency; (2) to buy new books for a library; (3) to build a visitor information center and to advertise traveling spots; (4) to develop a series of activities on music, dancing, arts, and the like for adults and children; (5) to build a shelter for the homeless; and (6) to buy art works to enrich the collections of a museum. A preference task is different from an intelligence task. Usually, the former does not have correct answers. Group members have to communicate with one other to come up with a conclusion. Moreover, a preference task is more easily influenced under time pressure and under social influences compared with an intelligence task (Karau and Kelly, 1992).

3.6 Experiment Environment

This research experiment was also a laboratory experiment at the National Chung Cheng University. Therefore, it was conducted at the same time and at the same place. The GSS of the National Chung Cheng University was developed according to the Software-Aided Meeting Management (SAMM) of the University of Minnesota and the Group Systems of the University of Arizona. The system functions include criterion discussion, criterion summary, solution discussion, alternative proposal, evaluation, and vote.

3.7 Experiment Procedure

Before the experiment began, preparation jobs were required. The main jobs in the preparation stage included (1) introduction, (2) group classification, (3) a priori task, (4) training leaders, and (5) system training. The goal of the priori task is to let the group members observe who the appropriate leader is and then vote for him/her. The leader was trained with specific leadership styles, but the training did not cover task-related information. Finally, each participant was trained to use the GSS system.

In the experiment, subjects used the GSS to discuss the Personal Trust Foundation problem. The different leadership styles and time pressure classified this study into four cells. Time was controlled by the researchers. Subjects were asked to complete the task in five minutes. After the experiment, the subjects responded to a survey.

4. Data Analysis and Discussion

4.1 Demographics of Subjects

This study involved 180 subjects who were college and master's students in Taiwan. Their average age was 23.26 years. Within the sample, 106 (58.9%) were males. Among the subjects, 4.4% had high collaboration experiences, while 58.4% had medium, and 37.2% had few experiences. A total of 89.4% of the subjects had high frequency of using computers, while 10% had medium and 0.6% had low. Among the subjects, 65.5% had high typing speed, while 33.9% had medium and 0.6% had low speed.

4.2 Time Pressure and Leadership Style

To examine if the manipulation was successful, experimental time and questionnaires on time pressure and leadership style were examined using *t*-tests. Results showed that the groups under time pressure had larger pressure than those without time pressure (5.2 vs. 2.7, $p = 0.00$), felt less time in completing the task (4.3 vs 2.0, $p = 0.00$), had to complete the task in a shorter time (5.50 vs. 3.64, $p = 0.00$), and did not have enough time to think and react (3.68 vs. 2.13, $p = 0.00$). Further, experimental time in time-pressured groups was significantly shorter than in groups without time pressure (41.10 vs. 25.61, $p = 0.00$). Thus, the manipulation was successful, and the results were the same as those in Payne *et al.* (1988).

T-tests on leadership styles showed that subjects perceived that they had received less directive opinions from participative leaders than from directive

leaders (3.2 vs. 5.8, $p = 0.00$), and participative leaders opened more groups discussions than directive leaders (3.4 vs 2.1, $p = 0.00$). On average, there were significant differences between directive and participative leadership styles (3.47 vs. 4.75, $p = 0.00$). Hence, the manipulation of leadership styles was successful.

Content validity and construct validity were examined in this study. The questionnaires for decision quality were adopted from Gouran *et al.* (1978), and the questionnaires for process satisfaction and outcome satisfaction were adopted from Green and Taber (1980). These questionnaires were also examined by students in the pilot test before the formal experiment began. Thus, they had appropriate content validity. After the employment of factor analysis, some items with low factor loadings were deleted. Results of the factor analysis showed convergent and discriminant validity. These results are found in Appendix B. Cronbach's α was used to measure reliability. All the Cronbach's α values were larger than 0.8, achieving high reliability (Table 1).

Table 1
Cronbach's α

Dependent Variables	Cronbach's α
<i>Decision Quality</i>	0.8063
<i>Process Satisfaction</i>	0.8654
<i>Outcome Satisfaction</i>	0.8447

4.3 Descriptive Statistics of Dependent Variables

Dependent variables in this study included equality of participation, process satisfaction, the number of solutions, the number of solutions per minute, decision quality, and outcome satisfaction. No significant outliers for each dependent variable were found. The mean and standard deviation of these dependent variables are listed in Table 2 and Table 3.

Table 2
Descriptive Statistics of Dependent Variables

IDVs	No Time Pressure				Time Pressure			
	Participative		Directive		Participative		Directive	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
<i>Equality of Participation</i>	0.16	0.08	0.38	0.15	0.24	0.16	0.41	0.23
<i>Process Satisfaction</i>	27.96	2.44	24.00	5.23	26.67	2.12	23.07	3.23
<i># of Solutions</i>	38.40	8.73	32.53	7.21	26.40	4.48	19.27	4.17
<i># of Solutions/min</i>	1.02	0.22	0.86	0.42	1.01	0.18	0.78	0.18
<i>Decision Quality</i>	27.02	2.57	26.04	3.79	26.47	2.84	24.20	2.96
<i>Outcome Satisfaction</i>	22.98	2.27	20.71	3.92	22.40	1.48	20.93	2.32

DVs: Dependent Variables.

Table 3
Correlation Matrix of Dependent Variables

DVs	Equality of Participation	Process Satisfaction	# of Solutions	# of Solutions/min	Decision Quality	Outcome Satisfaction
<i>Equality of Participation</i>	1.00					
<i>Process Satisfaction</i>	-0.367***	1.00				
<i># of Solutions</i>	-0.401***	0.219**	1.00			
<i># of Solutions/min</i>	-0.370***	0.328**	0.384***	1.00		
<i>Decision Quality</i>	-0.315***	0.660***	0.151	0.098	1.00	
<i>Outcome Satisfaction</i>	-0.244**	0.716***	0.102	0.080	0.661***	1.00

** : $p \leq 0.05$; *** : $p \leq 0.01$, DVs: Dependent Variables

Table 4
The Results of MANCOVA

Variance Sources	DVs	SS	DF	F-value	p-value
<i>Decision Time (Covariate)</i>	Equality of Participation	0.003	1	0.096	0.75
	Process Satisfaction	29.962	1	2.550	0.11
	# of Solutions	419.880	1	12.160	0.00***
	# of Solutions/min	1.833	1	44.290	0.00***
	Decision Quality	0.607	1	0.060	0.80
	Outcome Satisfaction	0.006	1	0.001	0.97
<i>Time Pressure</i>	Equality of participation	0.034	1	1.240	0.26
	Process Satisfaction	44.339	1	3.940	0.05**
	# of Solutions	603.288	1	17.460	0.00***
	# of Solutions/min	1.002	1	24.210	0.00***
	Decision Quality	16.597	1	1.720	0.19
	Outcome satisfaction	0.337	1	0.040	0.82
<i>Leadership Style</i>	Equality of participation	0.572	1	21.170	0.00***
	Process Satisfaction	199.180	1	16.950	0.00***
	# of Solutions	719.573	1	20.830	0.00***
	# of Solutions/min	0.409	1	9.880	0.00***
	Decision Quality	38.364	1	3.990	0.05**
	Outcome satisfaction	51.729	1	7.260	0.00***
<i>Leadership Style X Time Pressure</i>	Equality of participation	0.007	1	0.262	0.61
	Process Satisfaction	0.010	1	0.001	0.97
	# of Solutions	0.246	1	0.007	0.93
	# of Solutions/min	0.110	1	2.650	0.10*
	Decision Quality	6.665	1	0.694	0.40
	Outcome satisfaction	2.317	1	0.324	0.57
<i>Sum</i>	Equality of participation	7.449	60		
	Process Satisfaction	39686.444	60		
	# of Solutions	56337.000	60		
	# of Solutions/min	55.426	60		
	Decision Quality	40948.667	60		
	Outcome satisfaction	28845.778	60		

*: $p\text{-value} \leq 0.1$, **: $p\text{-value} \leq 0.05$, ***: $p\text{-value} \leq 0.01$; DF: Degree of freedom, DVs: Dependent Variables, SS: Sum of squares,

4.4 Hypotheses Testing

Multivariate analysis of covariance (MANCOVA) was used in this study. Decision time was related to decision process and outcomes at the same time. Thus, decision time was included as a covariate. Independence of samples, normality, and homoscedasticity were examined to test the compliance with the assumptions of MANCOVA. Results showed that no assumptions were violated.

According to Table 4, for the interaction effects, H_{2c} was supported, but H_{1c} , H_{3c} , H_{4c} , H_{5c} , and H_{6c} were not. For the effects of time pressure, H_{1a} , H_{2a} , and H_{4a} were supported, but H_{3a} , H_{5a} , and H_{6a} were not. For the effects of leadership style, H_{1b} , H_{2b} , H_{3b} , H_{4b} , H_{5b} , and H_{6b} were supported. A discussion on the results follows.

4.4.1 Equality of Participation

H_{1a}: Under a GSS environment, equality of participation is higher in groups without time pressure than in groups with time pressure.

H_{1b}: Under a GSS environment, the equality of participation is lower in groups with participative leaders than in groups with directive leaders.

H_{1c}: Under a GSS environment, the interaction between time pressure and leadership style significantly affect the equality of participation.

According to Table 2 and 4, H_{1a} was not supported. The equality of participation for groups without time pressure was lower than that for groups under time pressure ($0.27 < 0.32$), but the difference was not significant. H_{1b} was supported. The equality of participation in groups with participative leaders was significantly lower than that in groups with directive leaders ($0.20 < 0.40$). H_{1c} was not supported; hence, there was no interaction effect. When most groups do not have members who try to dominate group meetings, the equality of participation under time pressure does not significantly decrease even when time pressure exists. Directive leaders usually try to persuade everyone that their ideas are great (Janis, 1982). Thus, the equality of participation under directive leaders is lower than under participative leaders. Moreover, under time pressure,

leadership style does not improve the equality of participation. The characteristics of groups may provide another explanation. Even with the guidance of directive leaders, the discussions may still not focus on certain members.

4.4.2 Process Satisfaction

H_{2a}: Under a GSS environment, the process satisfaction is higher in groups without time pressure than in groups with time pressure.

H_{2b}: Under a GSS environment, the process satisfaction is higher in groups with participative leaders than in groups with directive leaders.

H_{2c}: Under a GSS environment, the interaction between time pressure and leadership style significantly affect process satisfaction.

According to Table 2 and 4, *H_{2a}* was supported. Process satisfaction in groups without time pressure was higher than that in groups with time pressure (25.98 vs. 24.87). *H_{2b}* was supported. Process satisfaction in groups with participative leaders was higher than that in groups with directive leaders (27.31 vs. 23.53). However, *H_{2c}* was not supported. In groups without time pressure, members have greater process satisfaction (Janis, 1982). Participative leaders gain the respect of group members (Sosik *et al.*, 1997), and directive leaders ignore the opinions of group members (Larson *et al.*, 1998). However, the effect of leadership styles can neither increase nor decrease the effect of time pressure during the discussion process.

4.4.3 The Number of Solutions

H_{3a}: Under a GSS environment, there are more solutions in groups without time pressure than in groups with time pressure.

H_{3b}: Under a GSS environment, there are more solutions in groups with participative leaders than in groups with directive leaders.

H_{3c}: Under a GSS environment, the interaction between time pressure and leadership style will significantly affect the number of solutions.

According to Table 2 and 4, H_{3a} was supported. The number of solutions for groups without time pressure was larger than that for groups with time pressure ($35.47 > 22.83$). H_{3b} was supported as well. The number of solutions for groups with participative leaders was larger than that for groups with directive leaders ($32.40 > 25.90$). H_{3c} was not supported. It may be that the information processing procedures are different under time pressure (Janis, 1982). The lack of enough time for information searching and processing decreases possible solutions (Svenson *et al.*, 1990). Therefore, the number of solutions is larger for groups without time pressure. Participative leaders encourage members to discuss, and members like to share their own ideas (Peterson, 1997). Directive leaders do not care much about the ideas of the members (Larson *et al.*, 1998). Groupthink easily occurs (Janis, 1982); thus, the number of solutions for groups with participative leaders is larger than that in those with directive leaders. Moreover, the interaction between leadership style and time pressure is not significant.

4.4.4 The Number of Solutions per Minute

H_{4a} : Under a GSS environment, there are more solutions per minute in groups without time pressure than in groups with time pressure.

H_{4b} : Under a GSS environment, there are more solutions per minute in groups of participative leaders than in groups with directive leaders.

H_{4c} : Under a GSS environment, the interaction between time pressure and leadership style will significantly affect the number of solutions per minute.

According to Table 2 and 4, H_{4a} was supported. The number of solutions per minute for groups without time pressure was higher than that for groups under time pressure ($0.94 > 0.90$). H_{4b} was supported. The number of solutions per minute for groups with participative leaders was higher than that for those with directive leaders ($1.02 > 0.82$). H_{4c} was supported. The interaction between time pressure and leadership style affected the number of solutions per minute. The source of interaction is examined in Table 5. Under time pressure, groups of

participative leaders had more solutions per minute ($1.01 > 0.78$) than directive leaders. Figure 3 shows the results, which explain that under time pressure, the number of solutions per minute will be larger. Under participative leaders, group members will usually have more ideas. On the contrary, directive leaders are likely to construct and to inspire groupthink easily. Therefore, under time pressure, the number of solutions for groups with participative leaders is larger than that for groups with directive leaders.

Table 5
The Main Effects of the Number of Solutions per Minute

Source Variances	F-value	p-value
<i>Under time pressure, the impacts of leadership style on the number of solutions per minute</i>	12.09	0.002***
<i>Under no time pressure, the impacts of leadership style on the number of solutions per minute</i>	1.68	0.205
<i>Under participative leaders, the impacts of time pressure on the number of solutions per minute</i>	0.017	0.897
<i>Under participative leaders, the impacts of time pressure on the number of solutions per minute</i>	0.476	0.496

***: $p\text{-value} < 0.01$

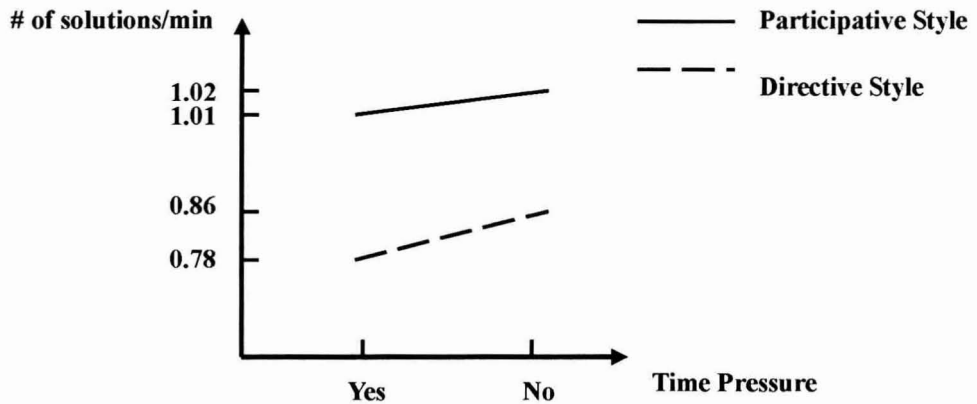
4.4.5 Decision Quality

H_{5a}: Under a GSS environment, the decision quality is higher in groups without time pressure than in groups with time pressure.

H_{5b}: Under a GSS environment, the decision quality is higher in groups of participative leaders than in groups with directive leaders.

H_{5c}: Under a GSS environment, the interaction between time pressure and leadership style will significantly affect decision quality.

Figure 3
The Interaction Effects of Time Pressure and Leadership Style on the
Number of Solutions per Minute



According to Table 2 and 4, H_{5a} was not supported. Decision quality in groups without time pressure was higher than that in groups under time pressure ($26.53 > 25.33$). However, the differences were not significant. H_{5b} was supported. Decision quality in groups with participative leaders was significantly higher than that in groups with directive leaders ($26.74 > 25.12$). H_{5c} was not also supported. Time pressure had an insignificant effect on decision quality. This may suggest that time pressure is not a main factor affecting decision quality. The insignificant interaction effect means that an appropriate fit between time and leadership style will not affect decision quality.

4.4.6 Outcome Satisfaction

H_{6a}: Under a GSS environment, the outcome satisfaction is higher in groups without time pressure than in groups with time pressure.

H_{6b}: Under a GSS environment, the outcome satisfaction is higher in groups of participative leaders than in groups with directive leaders.

H_{6c}: Under a GSS environment, the interaction between time pressure and leadership style will significantly affect outcome satisfaction.

According to Table 2 and 4, *H_{6a}* was not supported, but the outcome satisfaction in groups without time pressure was still higher than that in groups under time pressure (21.84 > 21.67). *H_{6b}* was supported. Outcome satisfaction in groups with participative leaders was significantly higher than that in groups with directive leaders (22.69 > 20.82). *H_{6c}* was not supported as well. Results indicate that leaders who encourage group members to express their own ideas are still better than leaders who ignore the ideas of group members from the beginning (Neck and Moorhead, 1995). However, the other two hypotheses showed insignificant results. When time pressure increases, group members will tend to avoid conflicting with one other and will turn to cooperate with one other (Stuhlmacher *et al.*, 1998). This may help group members obtain a satisfactory solution even if the time is shorter than normal. However, the improvement of outcome satisfaction may have its limits. Thus, under time pressure, directive leaders cannot increase outcome satisfaction to a higher level compared with participative leaders.

5. Conclusions

5.1 Discussions

GSS can reduce the pressure of peer groups, the fear to be evaluated by others, and obedience to authorities, and increase cooperation among group members (Nunamaker *et al.*, 1991). However, some research also indicate that GSS reduces decision quality (Straus and McGrath, 1994) and the number of ideas (Straus and McGrath, 1994), increases decision time (George *et al.*, 1990), and decreases members' satisfaction (Gallupe *et al.*, 1992).

These inconsistent results may come from a limited understanding of the factors and relationships causing the advantages and disadvantages of GSS. Time pressure and leadership style are two important factors of GSS. Time pressure

changes how group members interact with one other, and leadership styles guide both the discussion direction and the atmosphere of meetings. Hence, these factors were investigated in this study. The research results are herein summarized:

First, under the GSS environment, groups under time pressure have more process satisfaction, number of solutions, and number of solutions per minute than groups without time pressure. Group members may feel less satisfied with the discussion process because they think that their ideas are not well discussed. When time pressure occurs, the frequencies of communication and information exchange decrease. Thus, group members have less opportunity to think of new solutions from other members' ideas, and the total number of solutions decreases. The insignificant effects of time pressure on equality of participation, decision quality, and outcome satisfaction may have resulted from other factors that were not measured in this study, such as intelligence, educational background, emotion, and communication skills among group members. These factors may moderate the effects of time pressure on communication processes and outcomes.

Second, under a GSS environment, groups with participative leaders have more equality of participation, process satisfaction, number of solutions, number of solutions per minute, decision quality, and outcome satisfaction than groups with directive leaders. Leadership style clearly affects the performance of a group meeting. The main reason is that participative leaders encourage group members to contribute their own ideas regardless of whether the ideas are positive or negative. Participative leaders also encourage group members who speak less to join in the discussion, thereby increasing the equality of participation. Therefore, all of the group members think that the final decision came from their ideas, not just from a few. On the contrary, directive leaders ask everyone to follow their thoughts. Their discussions tend to converge into few solutions (Flowers, 1977; Janis, 1982). Thus, groups with participative leaders have better group performances.

Third, under time pressure, groups with participative leaders obtain more solutions per minute than groups with directive leaders. Time pressure differentiates the generation of solutions between participative leaders and

directive leaders. Groups with participative leaders still welcome different ideas. On the contrary, groups with directive leaders have less opportunity to participate in the discussion, and this situation becomes worse under time pressure. Members may not agree with the ideas of directive leaders, but they have less chances of arguing under time pressure. Thus, equality of participation, process satisfaction, decision quality, and outcome satisfaction in groups with directive leaders are all significantly lower than in groups with participative leaders. However, the interaction effects between time pressure and leadership styles are not significant for other processes and outcome variables. Despite the insignificant interaction between leadership styles and time pressure, participative leaders still have higher process and outcome evaluations than directive leaders. It may be that participative leadership is a preferred leadership style, but time pressure blurs the influences of leadership style. Under time pressure, group members discuss less; hence, the encouragement from participative leaders or the discouragement from directive leaders makes fewer differences than usual.

5.2 Implication for Researches

Prior GSS studies have rarely discussed the impacts of leadership style. They assumed that GSS only requires facilitators and do not need leaders. Hence, the influence of GSS leaders was not comprehensively discussed. Nevertheless, GSS leaders may increase or decrease the performance and even change the results of group meetings. For example, leaders can approve certain ideas of the group members and guide them to think in another way (Neck and Moorhead, 1995). A traditional meeting usually attributes its success to the efforts of leaders (Johnson and Bechler, 1998; Suutari, 1996).

Therefore, this study intends to discuss the impacts of leadership style on GSS performances to determine if it should be considered in future GSS studies. In addition, this study also wants to investigate whether GSS can reduce the negative effects of time pressure and whether there is interaction between time pressure and leadership styles. Results reveal that leadership style significantly affects group performance, the impacts of time pressure vary, and the interaction effect only occurs in the number of solutions per minute. These results may

indicate that GSS can reduce some negative effects caused by time pressure but cannot reduce the impacts of leaders. For GSS-related studies, the influences of leadership style are larger than experiment time.

5.3 Implication for Practice

Companies usually have to make decisions under time pressure. The results of this study show that GSS may improve certain decision performances, such as decision quality and equality of participation. It shows that GSS may be a tool that companies should try to eliminate the disadvantages of traditional meetings. However, appropriate leaders should be selected to lead group meetings. Participative leaders who welcome employees' opinions are better leaders in ensuring satisfaction among members.

5.4 Research Limitation

The research method of this study is a laboratory experiment. Its internal validity is high, but its external validity is low. One must be cautious in generalizing the results of this study to the business environment. Moreover, the subjects of this study are students, and company employees may have different behaviors. Finally, the background of the subjects may have also affected the experiment's results. The life experiences, value system, and cooperation experiences were randomized in the experiment, but they still affected the results. Groups with similar value systems usually have better group performance than groups with conflicting value systems. One must be cautious in applying the results to these conditions.

5.5 Directions for Future Research

Field experiments help increase external validity. Thus, a real task with company employees as subjects can be a better research direction in the future. A task that companies consider in evaluating employee's work performance will also help understand the effects of GSS in business decisions. Moreover, this study simply classified leadership styles as either participative or directive. Recent leadership studies have found numerous other leadership styles. For

example, transformational leaders do not think that organizational goals conflict with personal goals, and they try to find a balance for employees. Thus, employees treat organizational goals as personal goals, and transformational leaders do not need to guide the process of meetings. This kind of leadership style seems to be more compatible with the use of GSS. Will this new leadership style increase meeting performance under a GSS environment? Future studies may discuss the interaction between GSS and different leadership styles.

6. References

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Appendix A Measurement

This questionnaire includes 21 items. Please choose the points that match your feelings. Thank you.

1. Do you perceive leaders to be close to what kind of leadership style?
Participative 1 2 3 4 5 6 7 Directive
2. Do you perceive leaders to be close to what kind of intellectual stimulation?
Very Closed 1 2 3 4 5 6 7 Very Open
3. Do you perceive leaders to be close to what kind of consideration for conclusion?
Individual 1 2 3 4 5 6 7 Consensus
4. Do you feel time pressure?
Very Little 1 2 3 4 5 6 7 Very Much
5. Do you feel enough time to work on task?
Not Enough 1 2 3 4 5 6 7 Enough
6. Do you feel the focus on working quickly?
Very Little 1 2 3 4 5 6 7 Very Much
7. Do you feel less time to work on the task?
Not Enough 1 2 3 4 5 6 7 Enough
8. How do you perceive the group decision process?
Inefficiency 1 2 3 4 5 6 7 Efficiency
Inharmonious 1 2 3 4 5 6 7 Harmonious
Unfair 1 2 3 4 5 6 7 Fair
Doubtful 1 2 3 4 5 6 7 Clear
Unsatisfactory 1 2 3 4 5 6 7 Satisfactory
9. Overall, how do you perceive the decision quality of group meeting?
Poor 1 2 3 4 5 6 7 Good
10. Overall, how do you feel about the efficiency of this meeting?
Inefficiency 1 2 3 4 5 6 7 Efficiency
11. How do you feel about the result of this meeting?

- Unsatisfactory 1 2 3 4 5 6 7 Satisfactory
12. How do you feel about the feasibility of the conclusion of this meeting?
Low 1 2 3 4 5 6 7 High
13. How do you feel about the importance of this meeting?
Unimportant 1 2 3 4 5 6 7 Important
14. How do you feel about the discussion details of this meeting?
Rough 1 2 3 4 5 6 7 Detailed
15. How do you feel about the suggestion provided by participants?
Unconstructive 1 2 3 4 5 6 7
Constructive
16. How do you feel about that participants' discussion is moving toward conclusion?
Insignificant 1 2 3 4 5 6 7 Significant
17. How do you think about your responsibility to the final group decision?
Low 1 2 3 4 5 6 7 High
18. How do you think about the importance of your opinions to the final group decision?
Low 1 2 3 4 5 6 7 High
19. How do you think about your confidence to the correctness of the final group decision?
Low 1 2 3 4 5 6 7 High
20. To what degree, do you agree with the final group decision?
Low 1 2 3 4 5 6 7 High
21. To what degree, do you satisfy the group decision quality?
Low 1 2 3 4 5 6 7 High

This is the end of the questionnaire, thanks for your participation.

Appendix B**The result of factor analysis**

Items	Process Satisfaction	Decision Quality	Outcome Satisfaction
<i>PS1</i>	0.709		
<i>PS2</i>	0.750		
<i>PS3</i>	0.737		
<i>PS4</i>	0.668		
<i>PS5</i>	0.812		
<i>DQ1</i>		0.530	
<i>DQ2</i>		0.759	
<i>DQ3</i>		0.719	
<i>DQ4</i>		0.703	
<i>DQ5</i>		0.573	
<i>OS1</i>			0.719
<i>OS2</i>			0.833
<i>OS3</i>			0.633
<i>OS4</i>			0.544

PS: Process Satisfaction, DQ: Decision Quality, OS: Outcome Satisfaction