Group Support Systems: A Descriptive Evaluation of Case and Field Studies

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ABSTRACT: This paper presents a descriptive evaluation of 54 case and field studies from 79 published papers spanning two decades of group support systems (GSS) research. It organizes the methodology and results of these studies into a four-factor framework consisting of contextual factors, intervening factors, adaptation factors, and outcome factors. The tables will provide the GSS researcher with a summary of what has been studied. The appendices provide a detailed description of the methodology and the results.

KEY WORDS AND PHRASES: case studies, descriptive evaluation, field studies, group support system, research integration.

IN THE ERA OF THE INTERNET, millions of people are glued to their workstations for hours a day, and even "old style" Fortune 500 companies are adapting some characteristics of the virtual organization. Group Support Systems (GSS) provide the collaboration

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tools that many of these organizations use. This paper summarizes the published case and field studies on GSS use (by "real" groups in "real" meetings) to date, and provides an aggregate analysis of the methodology and results.

This study can be viewed as an updating of prior papers [4, 11] which compared laboratory and field research on GSS conducted in same-time, same-place decision rooms. It includes many more studies, of course. The prior papers found ten field studies that had been published in journals through the summer of 1990, whereas this one, a decade later, is based on 54 field studies.

Studies Included

WE LOCATED 54 DIFFERENT CASE AND FIELD STUDIES, published through mid-2000, that met our criteria for this analysis. First, the study had to be published in an English Language refereed journal or conference proceeding. For example, unpublished dissertations or non-refereed conference presentations are not included. Second, they were studies of one or more specific groups, which we defined as comprising at least three members. Third, they used a computer-based system with at least minimal features designed to support group communication and decision-making processes. The study had to be an action research, case study, or field study that required the group to work on a specific task, and that posed some sort of research question and collected some data to help to answer this question. The task in most cases was a "real world" task with no right or wrong solution. In three cases the task was part of the requirements for a course.

The results of some studies were presented in more than one paper. If the design of the study and description of the organization, subjects, and task were the same, the different papers were determined to be on the same study, and were given only one number. We thus have a total of 79 papers on the 54 different studies.

The Theoretical Framework

TO ORGANIZE THE INFORMATION IN THE STUDIES, we used the comprehensive theoretical framework previously developed to integrate and analyze all of the information for experimental studies of GSS. This integrated framework was developed on the basis of various contingency theory approaches to explaining GSS success, to provide complete coverage of factors present in the literature as a whole, and has been previously published [6, 7] and will not be reproduced here.

Categorization of the Studies and Results

THE MAJOR ASPECTS OF THE METHODOLOGY and outcomes of field studies on GSS, using the study as the unit of analysis, have been put into a database and organized into charts. Appendix 1 shows what studies are included and the references. Appendix 2 summarizes the methodology and other parameters for each study, and Appen-

Table 1. Factors Model: Contextual Factors (Unit of Measure is Case)

4.1 TECHNOLOGY

Task Support: Tools		Other	12	**Communication Mode**	
Agenda	1	Group Writing	1	CMC	9
Computer Model	1	Not Reported	2	DSS	1
Alternative Gen	3	**Process Structure**		GSS	44
Group Outliner	4	**Group Proximity**		**Design–GSS System**	
Cross Impact	1	Dispersed	9	Decision Conference	1
Topic Commenter	11	Decision Room	45	DecisionAnalytics	1
Ranking	4	**Anonymity**		EIES	4
EBS	23	Anonymity (A)	32	Email	2
IDEF	3	Identified (I)	22	EMS	1
Voting	17	**Facilitation**		Facilitator	1
Issue Organizer	10	Facilitator	34	GroupSystems	30
NGT	1	No Facilitator	11	Plexcenter	1
Standard Package	8	Chauffeur	9	PC Work Station	1
MCDM	2	**Time Dispersion**		GroupWise	2
Policy	3	Synchronous	45	SAMM	5
None	4	Asyncronous	9	TeamFocus	2
Categorizer	5	**Levels**		Teamate	1
Cost Benefit	1	Level 1	7	VisionQuest	2
		Level 2	47		

dix 3 summarizes the results. Tables 1 to 3 are summary counts of the variables from these charts.

What Has Been Studied: Contextual Factors

Table 1 shows the counts for the technology subfactor. Table 2 highlights the counts for group and context subfactors of the contextual factors and the intervening subfactors.

Technology

Communication Mode

Group Support Systems have been classified into three primary types (Table 1): “DSS” (Decision Support Systems) GSS, or “CMC” (Computer-Mediated Communication). The majority of the studies (81.5 percent) used a GSS.

CMC refers to a system designed primarily to support text-based and generally asynchronous (or anytime-anywhere, through computer networks) group discussion,

Table 2. Factors Model: Contextual and Intervening Factors (Unit of Measures is Case)

4.2 GROUP	
Group Composition (Subject Type)	
Professionals	34
Management	3
Senior Management	8
Military	4
Software Engineers	1
Students	4
Leadership	
Leader	12
Not Reported or no Leader	41
Emergent Leader	1
Task Implementation	
Alternative	2
BPR	11
Competitive Advantage	2
Contract Negotiation	1
Economic Development	2
Idea Generation	1
Judgment	2
Manufacturing	1
Planning	7
Models	1
Software Development	2
Strategic Planning	19
Course Project	2
Foundation Task	1
4.4 CONTEXT	
Organization Types*	
University	7
Manufacturing	6
Computer	3
Communication	2
Government (U.S.)	9
Government Non-U.S.	6
Medical/ Hospital	3
Utility	2
Military/ Defense	6
Oil	2
Consulting	2
Other	9
University Course	3
Insurance	1
Accounting/ Bank	2
Nation	
Hong Kong	2
European	1
Denmark	1
German	1
Mexican	1
Netherlands	8
South Africa	1
USA	34
Australia	1
New Zealand	3
Mixed	1
INTERVENING	
Method	
Action Research	10
Case Study	27
Field Study	15
Quasi-Experimental Field Study	2
Number of Sessions	
1	4
2	5
3	3
4	3
5	3
6 to 9	5
10 to 13	4
29	1
Multiple	6
NR	21
Training	
Not Reported	29
Training Mentioned	18
None	3
120+ min	2
Session Length	
< Day	10
1 < 4 Days	7
1 < 3 Weeks	6
Multiple Sessions	9
Asynchronous	9
Not Reported	12
Group Size (Subjects per group)	
range to 10 or less	14
range to 20	19
range to 30	4
range to 40	2
range to 60 plus	3
Not Reported	12
Data Collection	
Questionnaires	36
Interviews	26
Observations	21
Session Logs	19
Case Reports	3
Metrics	1
Self Completion	1
Project Grade	1
Comparisons	2
Comments	1
Ideas generated	1
Content analysis	1
Not Reported	3
Ballots	1

Table 3. Factors Model Outcome Factors (Unit of Measures Is Measure)

1. Efficiency	
Measures	
Improved	28
Did not improve	1
No difference	1
No Measures	24
2. Effectiveness Measures	
Improved	39
Did not improve	2
No difference	3
No Measures	10
3. Satisfaction Measures	
Process Satisfaction	
Improved	20
No difference	2
No Measures	32
Outcome Satisfaction	
Improved	11
Did not improve	2
No difference	1
No Measures	33
Participation	
Improved	16
Did not improve	3
No difference	0
No Measures	35
4. Consensus Measures	
Improved	8
Did not improve	3
No difference	0
No Measures	43
5. Usability Measures	
Improved	12
Did not improve	2
No difference	1
No Measures	39

Improved:

Process support	Flexibility
Process structure	Divergent and convergent
Task structure	Enriched communication
Information exchange	Improved focus
Role perceptions	Increased number of ideas
Communication	Reduced stress
Number of ideas	Knowledge and knowledge sharing
The ability to deal with task complexity	High trust groups are effective and have active participation
Cohesiveness	

such as a computer conferencing or bulletin board system, that may or may not have GSS tools included. A total of nine studies (16.7 percent) used a CMC system.

Systems

Eleven different systems were used. GroupSystems (developed at the University of Arizona) and its predecessors accounted for 55 percent (30/54) of the GSS systems; SAMM from the University of Minnesota was used in five studies; and EIES from The New Jersey Institute of Technology was used in four instances.

Tools

The tools included in GroupSystems and its predecessors are the most frequently employed. The most frequently used task support tool is Brainstorming (23 studies)

for idea generation, followed by Voting (17), Topic Commenter (11), Issue Organizer (10), and Categorizer (5). These tools were primarily used by the groups to elicit new ideas and organize them. It is interesting to note that only a few specialized tools were used: IDEF (Integrated Computer-Aided Manufacturing Definition) tools (3), Nominal Group Technique (1), and Multicriteria decision-making (2).

Process Structures

Eighty three percent of the studies were synchronous decision room–based. Of the nine studies that were asynchronous, six were used in organizational settings. The other three were used in an academic environment. Anonymity was employed in 59 percent of the studies.

Level

The "level" of the GSS or CMC system is a rough coding of its sophistication in terms of GSS features, and follows the descriptions of "level 1" and "level 2" systems by [5]. The majority of the systems used (87 percent) are level 2 systems.

Facilitation

The case and field studies primarily used facilitation methods (62.9 percent, or 34/54 of the studies).

Group

For the case and field studies all of the group variables were treated as moderator variables. It was surprising that most field studies did not explicitly report whether the groups were established or ad hoc.

Group Composition

The case and field studies utilized mostly (92 percent) professionals. Managers, senior managers, or professional staff were utilized in 45 studies, and military or Department of Defense personnel in another four instances.

Leadership

Most organizational project groups have leaders. However, most of the studies (41 instances) did not report if there were assigned leaders for the task groups.

Task

Task Type Implementation

Fourteen different categories of task implementations were used in the case and field studies. Nineteen (35 percent) of the tasks were strategic planning and 11 were business process reengineering tasks.

Context

This includes environmental and organizational variables. The case and field studies typically did not report many important bits of information, such as the environment, time pressure, and culture. The most frequent was the U.S. government, with nine studies, followed by seven from university settings and six from manufacturing. There were also six from foreign governments [9, 10, 13].

Culture/Nationality

Though dominated by U.S. studies, the approximately one-fourth from a variety of other cultures is a very good start toward the ability to assume that generalizations about use and impacts of GSS do hold for at least the "developed" world. Eleven studies, including eight from the Netherlands, were European-based. There were also three from New Zealand, one from Australia, and two from Hong Kong. In terms of the less developed nations, however—which actually represent the majority of the world's population—there were only one from Mexico and one from Africa.

Intervening Factors

The intervening variables include two major categories: methods and summary constructs. (Summary constructs are beyond the scope of this paper; see [6].) Methods represent the basic manipulation and measurement techniques that are available to the researcher, including study design, task implementation, session length, number of sessions, and training (Table 2).

Method Study Design (type)

Fifty percent (27 of 54) of the studies were described as case studies and another 28 percent (15 of 54) were field studies. Ten studies were action research. There were two quasi-experimental field studies.

Training

Twenty-nine studies did not report on this important detail of the methodology at all. Another 18 mention that some sort of training was given, but no details are provided.

Number of Sessions

Slightly over one-third (21 out of 54) of the studies did not report the number of sessions the groups participated in. Fifty-four percent of the case and field studies did have at least two or more sessions reported.

Session Length

In the case and field studies, 59 percent of the groups spent extensive time on their task: Either they had multiple sessions (9), or between 1 and 4 days (7), or between 1 and 3 weeks (6), to complete their tasks. Nine of the studies were asynchronous, extending over weeks, months, or even years.

Group Size (Subjects per group)

The ranges for the number of subjects per group are quite variable. They go from five or six subjects per group up to 60 plus.

Data Collection

Most of the studies use multiple methods to collect data. Thirty percent of the studies use questionnaires, 22 percent use post-case interviews, and 16 percent use session logs to aid in the analysis.

Outcome Factors

Table 3 shows the results of the outcome factors for the 54 case and field studies. Most of these results are based on subjective perceptions from questionnaires or interviews, or the judgment of the researchers. However, some of the efficiency and effectiveness measures are quantified.

Efficiency

Sixty-two percent (28 out of 54) of the case and field studies suggest that efficiency was improved over manual or face-to-face methods. Ninety-three percent (28 out of 30) of those that measured efficiency outcomes report improvements. Many of the time savings reported are quite impressive. For example, Bikson [1] describes GSS use in 102 sessions at the World Bank as "vastly more efficient" than other meetings. Dean et al. [2] quantified efficiency in a business process reengineering task using IDEF tools, finding that participants produced "251 percent more activities and 175 percent more ICOMS per day." In another study using IDEF, Dennis et al. [3] found that completed models took only one week for the GSS groups, versus 6 weeks for traditional processes.

Effectiveness: Eighty-nine percent (39 out of 44) of the studies that measured effectiveness report that effectiveness was improved using GSS technology in comparison to other methods. Though most of these measures are based on subjective impressions of participants, some were able to quantify the increased effectiveness. For example, Post's [8] study of 64 sessions in a major manufacturing company claims that GSS saved $432,260 while improving the quality of decisions. Van Genuchten et

Table 4. Characteristics of Successful and Unsuccessful GSS Implementations

Successful Implementations	**Unsuccessful Implementations**
Facilitator	No Facilitator
Leadership	A dominating or unenthusiastic leader
Many sessions	Few sessions
Training on the technology	No training on the technology
Complex tasks	Trivial tasks
Idea generation task for Decision Room GSS	
Decision making tasks for Asynchronous CMC	
Permit verbal and electronic communication	Discourage verbal communication
User defined approaches	Limited approaches
Culturally sensitive implementations	
Anonymity	Misappropriated Anonymity
High trust	Low trust

al. [12] counted code defects found during software inspection meetings and found the number to be "considerably" higher than for traditional meetings

Satisfaction: Three separate measures of satisfaction are included: process satisfaction, outcome satisfaction, and participation. The results clearly suggest that groups are more satisfied with the technology and processes of GSS compared to manual or face-to-face meetings. When analysis is offered of reasons for overall improvements in satisfaction, the most frequent themes are that it is due to an improvement in process (more participation, due to simultaneous input and/or anonymity features of the medium) and/or to perceived greater quality of the results.

Consensus was measured only in 11 instances, eight of which report positive results.

Usability of the systems is perceived positively in 12 of the 15 studies that measured it.

Overall Outcomes combines all of the results measures listed above. In comparison to the experimental studies, where the overall positive effects of GSS technology were only 16.6 percent, the overall positive effects reported for the case and field studies is 86.5 percent (134 out of 155).

Characteristics of Successful and Unsuccessful Implementations

In order to aid the GSS researcher and organizational manager we compiled Table 4, which highlights the characteristics of successful versus unsuccessful GSS implementations. This list is not all-inclusive, but a guide based upon 54 case and field studies that we evaluated.

Discussion and Conclusions

THE OBJECTIVE OF THIS PAPER is to provide the GSS researcher and organizational manager with an up-to-date descriptive evaluation of the GSS research in organizations. The results suggest that many different types of organizations have explored using GSS technology to improve many aspects of business decision-making. Most

of these have been in a decision room environment using a facilitator. Several recent studies have used asynchronous GSS technology without facilitators to achieve the same ends. These results are very promising. The groups report that the technology improves efficiency, effectiveness, consensus, usability, and satisfaction above that of manual methods.

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Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Adelman, 1984	DSS: Decision-Analytic, Level 2, Decision room, Tools: multi-attribute, Cost benefit, Training?	Case Study Data Collection: Comparisons between non-DSS and DSS	Military, U.S. Marine Corps	1 group; Professionals.	Alternative design analysis, cost benefit analysis	Two 2-day sessions.
Adkins, Sheare, Nunamaker, Romero, & Simcox, 1998	GSS: GroupSystems, Decision room, Level 2, Anonymity, Facilitator, Tools: EBS, Topic Commenter, Group Outliner, Categorizer; Training not described, Processes NGT.	Field Study; Data Collection: Post questionnaire. Quality ratings of plans by experts. Variables measured—quality of plan, time, & satisfaction with process, commitment to plan.	Organization military/ government—Air Force base in Idaho. Size 1000s (large). Departments observed staff and operational ("wing command")	10 groups; Group characteristics: 3 staff groups & 7 squadrons experimental; 17 squadrons traditional FtF; subjects per group—range not stated Total subjects 365, military personnel.	Strategic planning	3 Months
Alavi, 1993	GSS: Vision Quest, Decision room, Level 2, Anonymity, Facilitator, Leader, Tools: electronic brainwriting and rating, Training: minimal, for group leaders only.	Field Study; Data Collection: post meeting questionnaires, interviews with meeting leaders, analysis of EMS meeting transcripts.	Organization head-quarters of a Mid-Atlantic Fortune 500 company; Departments observed—various, including marketing, personnel, operations management, and legal.	23 groups; Group characteristics—varied between peer and hierarchical; ad hoc and permanent project teams; subjects per group 3 to 15; mean size 8.4; total subjects 167; first time users of EMS.	Idea generation and evaluation (generative) Tasks from different domains (marketing, human resources)	1 session per group Length of study 3 months
Bikson, 1996	GSS: GroupSystems, Level 2, Decision room, Facilitator and technographer, Anonymity. Tools : EBS, Categorizer, Group outliner, Vote. Training: Yes.	Case Study Data collection: interviews, memoranda, newsletters, session logs, reports.	Organization: World Bank. Departments—Organizational design, planning and services (ORG) and information technology and facilities (ITF).	102 GSS sessions. The participants were from country operations and from personnel and administrative services. The GSS room was used at 50% of capacity.	The business needs: decrease decision time and action cycle times while responding to increasingly complex and urgent resource allocation problems. Meeting planning, attitude survey, brainstorming, focus groups.	Length was not reported. The GSS sessions extended over a 9-month period.

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Briggs, Adkins, Mittleman, Kruse, Miller, & Nunamaker, 1999	GSS: GroupSystems, Level 2, Decision room, Facilitator, Leader, Tools: complete set; Training: none required.	Action Research Theory: Technology Acceptance Model (TAM). Data collection: testimonies, interviews, observations, and experience.	US Navy fleet command: Strategic and operational decision making.	Multiple groups of different size and composition.	Strategic, tactical and operations planning tasks	Single and multiple sessions over 4 years.
Caouette & O'Connor, 1998	GSS: GroupSystems, Decision room, Level 2, Anonymity, Facilitator, Leader, Tools? Training?	Quasi-experimental Field Study; Tuckman's stages of development: forming, storming, norming, performing and adjourning questions: Meeting sessions recorded and transcribed and coded; Interviews; field experiment 2 (modes) by 2 (problems), by two orders of mode; repeated measures	Organization New York financial guarantee insurance company; Size small (100 employees), 5 years old.	2 groups; 8 subjects per group; total subjects 16; executives	One macro (strategic) planning task, 1 micro planning	Two half-day sessions, the same day.
Carmel, Herniter, & Nunamaker, 1993	GSS:: GroupSystems, Level 2, Decision room, Anonymity, Chauffeured, Leaders, Tools: Win-Win; EBS, Topic commenter, Ranking, group memory; Training: yes; Process: Negotiations Support—Win-Win	Stage model of Negotiation; Action Research; Data Collection: questionnaires, interviews, direct observation, document collection	Health Center Major issues—Management side: competitiveness, recruitment & retention, malpractice insurance, And focus on the doctors. Union: wages, jobs, focus on medical support staff.	2 groups—management and labor Union 11 participants; Management #? Union members had limited computer experience	Contract Negotiation task.	13 sessions, 57 total hours over 1 month.
Corbitt, Christopolus, & Wright, 2000	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: EBS, Topic commenter, group writing, Vote, Training: ?	Case Study Data collection: session logs, questionnaires, interviews.	Government agency Environmental remediation	2 groups consisting of production and staff support workers; 6 to 17 subjects per session	Business process reengineering	4 sessions once a week for 5 weeks; 2.5 to 7.3 hours in length.

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Davison, 2000	GSS: GroupSystems, Level 2, Decision room, Tools: EBS, Topic commenter, vote, Training: Yes.	Case study; Data collection: Session logs, questionnaires, ballots	Academic organization consisting of 41 members from the department of information systems. Hong Kong.	1 group, 6 subjects, academic	Generating system requirements for a bibliographic information system	Email use initially to derive basic functionality; GSS used to support detailed idea generation. 2 GSS sessions, one week apart, 20 and 50 min.
Davison & Vogel 2000	GSS: GroupSystems; Level 2, Decision room, Anonymity, Tools: Not reported, Training? (Asynchronous email, telephone in between).	Action research. Facilitator is the researcher. Data collection included observation, discussions with participants via FtF, telephone and email; meetings with the leader/CIO; questionnaire after several of the meetings.	Hong Kong Accounting firm (medium sized, international)	One group of 7 headed by the CIO. Subjects in 20s and 30s.	Revise the client billing system	11 meetings over 6 months.
Dean, Lee, Orwig, & Vogel, 1994; 1995	GSS: EMS-IDEF, Level 2, Decision room, Facilitator, Tools: IDEF, EBS, Alternative generator, Training yes, on modeling method and tool, Media processes IDEF modeling method, a structured analysis and design technique.	Quasi-experimental field study.	Organization—U.S. Department of Defense	8 groups; Subjects per groups Average 9.4 (FtF), 19.7 (GSS); Professionals	Task: modeling of business activities for Business Process Reengineering.	Session length = between one and 3 weeks.

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Dennis, 1994	GSS: GroupSystems, Level 2, Decision room, Anonymity, Facilitator, Tools: Basic set, Training: No.	Case Study design with a semi-Independent variable—meeting style (interactive, supportive, chauffeured, non-GSS) measured as electronic intensity, the higher the score the greater the electronic use. Data collection: Questionnaires.	5 Organizations US Army, University of Arizona Hughes Aircraft IBM Bell South	10 groups from 5 different companies; 8 to 24 subjects per group; 152 total subjects; professionals	Real organizational tasks; Judgmental decision making; Type 4	Multiple sessions ranging from half a day to 14 days.
Dennis, Daniels, Hayes, & Nunamaker, 1994	GSS: EMS-IDEF, Level 2, Decision room, Facilitator, Tools: IDEF, Training: GSS several hours, FtF several days	Field Study Comm Mode: GSS (EMS-IDEF), FtF (traditional)	Large Multinational firm	23 Groups; 11 and 12 groups per cell; 6 to 60 subjects per group; 283 total subjects; Professionals	Actual models developed for DOD, Corps of Engineers; Type 1 to 8	GSS 4.5 to 13 days; FtF 20 to 100 days.
Dennis, Hayes, & Daniels, 1999	GSS: GroupSystems, Level 2, Decision room, Anonymity, Facilitator, Tools: IDEF, Training—Yes.	Field Study: comparing 9 FtF and 9 GSS treatment groups. Data collection: Interviews and case projects.	DoD projects	18 groups; 9 groups per cell; 6 to 75 subjects per group; 304 total subjects; military officers-majors	Installation management and logistics projects.	Not reported
Dennis, Heminger, Nunamaker, & Vogel, 1990	GSS: GroupSystems, Level 2 decision room-24 station, Facilitator and 4 assistants, Tools: EBS, Issue Identification and Analysis, Topic Commenter, File Reader and Voting Training? Processes: 3 pre-planning meetings	Field Study. Automated participation logging, post session questionnaire, follow up interview with CEO and 2 managers 3 months later	Organization: Burr Brown, 1500 employees; Manufacturing—electronic parts	1 Group; 26 subjects; Group characteristics) hierarchical, including CEO; subjects per group 31 total subjects 31; senior managers	Strategic planning	Six GSS sessions over 3 days;, 3 FtF pre-planning sessions.

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Dennis, Nunamaker, & Paranka, 1991	GSS EMS, Level 2, Decision room, Anonymity Facilitator, Tools: EBS, Topic commenter, Idea organizer, Training?	Case study with no manipulated variables. The intent was to examine strategic planning & competitive analysis using EMS technology and tools.	5 Organizations Utility Company Financial Corporation Management College	5 groups; 12 to 30 subjects per group; 107 total subjects; Senior managers	Real business tasks: Competitive advantage strategies; Type 2, 3, 4, 5, 6	1 to 3 sessions for each group, 1 to 2 day sessions each.
Dennis, Tryan, Vogel, & Nunamaker, 1997	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: EBS, Topic commenter, Issue analyzer, Vote, Idea organizer, alternative evaluator, Policy formation, stakeholder-SIAS. Training?	Field Study. Theory: Venkatraman & Ramanujam Model Data collection: Case reports, interviews Measures: GSS capabilities-Task support, process support, task structure, process structure	30 organizations first time use on strategic planning. Manufacturing, consulting, hospital, university, government, Restaurant, real estate, Utility, bank.	30 groups; 11 to 38 subjects per group	73% were involved with strategy formulation, 37% in goal formulation, 30% in environmental analysis, and 20% in strategy evaluation	Sessions went from a half day to 4 days.
DeSanctis, Poole, Dickson, & Jackson, 1993	GSS: SAMM, Level 2, Decision room, Anonymity, leader, Tools: EBS, Vote, agenda, Training?	Field Study; Theory: AST; Data collection: questionnaires, observations, interviews, video tape	Texaco, Oil company Information technology department	3 groups; 14, 8, 7 subjects per group; 29 total subjects	Tasks: New technologies planning, End user support, data center automation; Task complexity—High to moderate.	Team 1: once a week for 2 hours; Team 2 once every 3 weeks for 1 to 2 hours; Team 3 once a week for 1 hour.
DeSanctis, Poole, Lewis, & Desharnais, 1991;1992	GSS: SAMM, Level 2, Decision room, Tools: Basic set, Training?	Case study with no manipulated variables. Assessment of quality improvement processes at the IRS.	IRS/NTEU joint quality improvement process	10 groups plus others; group size not reported; total subjects-unknown; professionals	Real business task: Quality improvement; Type 2, 3, 4, 5, 6	Multiple sessions, unknown length.
George, Nunamaker, & Valacich, 1992	GSS: GroupSystems, Level 2, Decision room, Tools: basic set, Training: Yes.	Case study Data collection: interviews. Purpose of system was organizational innovation.	Government Indian Health Service; Staff and area meetings.	2 separate groups: 12 dental program directors and 12 local department members	No task was reported. The groups used the GSS for a routine meeting	2 session; 2 different groups; .length not reported.

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Genuchten, Cornelissen, & Dijk, 1998	GSS: Group Systems, Level 2, Decision room, Facilitator, no Leader, Tools: Categorizer, Training?	Case study. Data collection: comments during logging, post meeting questionnaire, counts of errors identified or found later.	Organizational Context Philips Medical Systems and the Baan Co. Netherlands.	14 groups; 4 subjects per group; professional software engineers.	Logging meeting for "Fagan inspections" of software development documents, detecting defects in code; type: intellective.	Not reported
Herik & Vreede, 1997, in-press	GSS: GroupSystemsV, Level 2, Decision room, Anonymity, Facilitator, Tools: topic commenter, idea organizer for brainstorming, voting, Training: ?	Action Research. Methods: participant survey, interviews with session initiator and selected other participants; participant observation as facilitator; system logs.	Danish Ministry of Housing, Spatial Planning and the Environment (VROM)	Case 1: Ruimpad, 6 from VROM + 3 from traffic board; had been working together for 1.5 years. Case 2: 50 people involved in heterogeneous groups of 11—13.	Case 1: Long term transportation planning. Case 2: Environmental planning,	Case 1: Multiple sessions, length not reported; Case 2: Multiple sessions over 3 weeks.
Hiltz & Turoff, 1991	CMC: EIES, Level 1 Distributed, Asynchronous, Facilitators, Leaders, Tools: None, Training: 2 days. Also, 3 FtF meetings (pre training and orientation; 3 months interim meeting; final DC meeting.	Case Study: Mailed pre & post questionnaires, interim online questionnaire, participant observation, system usage statistics. Theories: Critical Success Factors and Media Richness	Senior executives and researchers	168 participants in 7 groups of 21—32 members.	Formulate and reach consensus on private sector recommendations for the White House Conference On Productivity.	4 months
Iacono & Weisband, 1997	CMC: Email, Level 1, Distributed, Asynchronous, Video conferencing, Tools: none; Training ?	Case study Data Collection: 1. transcripts content analyzed 2. projects graded for whole group 3. individuals graded for frequency, number and quality of email posts 4. Survey questionnaires pre task Analyses were categorized by performance on a group project Organizations: 3 U.S. universities		14 groups; 3 subjects per group; 42 total subjects; Graduates and undergraduates.	task: week one: introduce themselves. Week 2: Select a project topic in social issues of computing and organize themselves. Week 3: research, write, and present a 5 page policy paper. Type 4,6	3 week asynchronous session

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Jarvenpaa, & Leidner, 1998	CMC: Email, Level 1, Asynchronous + Synchronous CMC, using listserver email and personal email, Tools: none, Training: none. No assigned leader, emergent leaders.	Field study: Theories: TIP (McGrath); Cultural values (Hofstede); SIDE (Social Identification/Deindividuation theory, (Lea &Spears 1992) Data: group email archives, 2 online questionnaires; Content analysis of 12 teams.	"Virtual teams," as course assignment for IS graduate courses, including 350 masters students from 29 universities who participated over 6 weeks in 1996. Students receive course credit; best team wins $600	Teams of 4 to 6 in which each member resided in a different country; exercise counted at least 20% of course grade. 75 teams started; 29 had 2 or members who completed both questionnaires. These 29 were categorized as HI or LO on trust before and after; the 3 most extreme teams in each cell were chosen for content analysis.	1—exchange information about themselves;;2, gain experience with the World wide web; 3. Propose and develop a Web site providing a new service for IS World Net.	Two one week warm-up/practices sessions; One four week asynchronous session.
Kock, 1998	CMC: Groupwise—Novell, Level 1, Self appointed leader, Tools: none—attachments, Training ?	Action Research Data collection: structured and unstructured interviews, and transcripts from electronic postings.	University process improvement groups from 15 different departments. New Zealand	5 groups; 7 to 13 subjects per group; 50 total subjects; professionals—faculty and staff.	Task: process improvement.	Asynchronous and FtF over 7 months.
Kock & McQueen, 1998	CMC: Groupwise—Novell Level 1. Anonymity, Facilitator, Leader, Tools, Training ?	Action Research participant observation, unstructured and structured interviews, and transcripts of the email discussions, analysis of organizational documents.	Two New Zealand Organizations 1. a school of studies of a university; 2. Ministry of agriculture and fisheries university, government Depts. observed—2 university depts.; MQM, 18 management of quality depts. in agriculture organization.	7 groups; subjects per group 5 to 15: 64 total subjects; professionals. All subjects had prior FtF participation in BPR meetings.	Task: process improvement (3 stages: definition, analysis and redesign)	Length of study/ group interaction 14 to 33 days; total observation 2 to 6 months

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Krcmar, Lewe, & Schwabe, 1994	GSS: GroupSystems, Decision room, Anonymity, Facilitator, Tools: EBS, Outliner, idea organization, idea evaluation, voting, alternative evaluation, Training ?	Case Study Data collection: questionnaires, interviews, system monitoring	Social club, Business BPR, and an academic group Germany	8 to 15 subjects per meeting	Case 1:Social club to allocate funds to worthwhile people; Case 2: BPR; Case 3: Academic publishing	1 to 8 hours in one day. Up to 3 days of sessions
Lewis, Keleman, & Garcia, 1990	GSS: Facilitator, Decision room, Level 2, Anonymity, Facilitator: Technical consultant, Tools: NGT, Idea generation, ranking, cross impact analysis, Training: Yes—4 hours.	Case study. Data Collection: questionnaires	Organization: Whatcom County, Washington; A project consisting of 22 local public and not for profit organizations.	3 groups; 5 subjects per group; 15 total subjects; Type: mid career professionals	Economic development of the region	Number of sessions: 2 Session length: 4 hrs.
McCart & Rohrbaugh, 1989	GSS: Decision Conferencing, Level 2, Decision room, Anonymity, Facilitator: 3 facilitators—process facilitator, analyst to support computer modeling, and "correspondent" who documents discussion and process, no Leader, Tools: computer model, Training?	Case study. Theory: T. Parsons AGIL four functions theory of social systems; "Competing Values Approach" Data collection: Self completion questionnaire	Organization: New York State Government Departments	14 groups; chosen from those hosted over the 1982-1985 period; Group Size varied; professionals.	Task: Planning	Original meetings 2 days; this study a follow up years later
Markus, 1992	CMC: Teammate, Level: 1 Anonymity—No, Facilitator-No, Tools: none Training: yes, extensive	Case Study. Data collection: internal and external, interviews, transcripts.	Student teams produce a report which describes a strategic problem or opportunity facing a company, an analysis of it, and recommendations	4 groups; 3 to 4 subjects per group; 15 total subjects;: MBA students	Students do a strategic consultation for a company.	Asynchronous and synchronous communication over 6 months.
Morales, Moreira, & Vogel, 1995	GSS: GroupSystems, Level 2, Decision room, Anonymity, Facilitator, Tools: Basic set, Training: ?	Case Study; Theory-AST; Data collection: Data: post questionnaires, facilitator observations.	Development planning groups in Mexico, held at the Monterrey Institute of Technology.	Mexicans; 293 senior business and government officials; N of groups not specified. One group was size 18	Regional development project—Strategic.	Session length 2hours and 15 minutes.

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Muller & Vreede, 1995; 1995	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: Idea organizer, Vote, Group dictionary, Group matrix, Training ?	Case study utilizing Co-operative computer augmented concept development method; Data collection: questionnaires.	Organization: PIT Telecom; Internal departments: marketing, sales, R & D; external: customers, users, dealers, etc. Netherlands	Marketers & engineers, (product developers), consumers, & PIT employees	Strategic planning: "added value services:"	5 sessions; no other information available.
Niederman & Bryson, 1998	GSS: SAMM, Level 2, Decision room, Facilitation, Tools: idea generation, idea evaluation, group messaging, Training: Yes	Single Case experiment Data collection: questionnaires, communication logs, and interviews	A large operating foundation which provides management consulting to non-profit organizations.	1 group; 6 to 8 members; professionals.	Problem formulation tasks	6 sessions; the first 2 sessions used FtF, the next 4 used GSS. One session a month
Nunamaker, Applegate & Konsynski, 1987;1987	GSS: Early GroupSystems, Level 2, Decision room, Anonymity, Tools: EBS, Idea structuring & analysis, vote; Training?	Case studies: Data collection: Questionnaires, observations.	Organizations: Government, Computer manufacturing, State University	7 groups; 6 to 22, average of15 subjects per group; 106 total subjects; high level managers	Strategic planning	3 sessions per group over 3.5 months. Average session length 4 hours.
Post, 1993; 1992	GSS: TeamFocus, Level 2, Decision room, Facilitator, Anonymity, Tools: basic set, Training: yes.	Case study. The intent was to collect effectiveness and efficiency data to evaluate business cases.	Major manufacturing corporation	64 groups; average group size 10.2; 654 total subjects; Professional.	Real business tasks: Planning, strategy, require definition; Type 2,3,4,5,6	64 sessions; several are multiple sessions. Average time 4.7 hours.
Quaddus, Atkinson, & Levy, 1992	GSS: Single PC work station, Level 2, Decision room, Facilitator, Analysts, Tools: MADM, Training: On tool.	Case study: Action research type—participants evaluate current situation and future vision.	Independent Living Center, Western Australia	1 group; 11 subjects; top executives	Strategic planning—future direction and implementation; Type 5.	Preconference preparation session; two day session.

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Sheffield & Gallupe. 1993;1994; 1995; 1995	GSS GroupSystems. Level 2, Decision room, Anonymity, Facilitator, Tools: Topic commenter, vote; Training: ?	Case Study. The intent was to collect data on several economic policy making meetings. Implementation activities from follow-up interviews are also included.	Organization: New Zealand's Competitive advantage project	12 groups; 14 to 33 subjects per group; 254 total subjects; Professionals	New Zealand's economy; Mixed motive; Type 5	5 sessions, 30 minutes to 3 hours for each session in one 8 hour day.
Vician, DeSanctis, Poole, & Jackson, 1992	GSS: SAMM, level 2, Decision room, Anonymity, Leader, Tools: agenda, idea gathering, idea evaluation, decision models, communication, Training: ?	Research model: Input-processes-outputs. Case study. Data collection: interviews, observations, session logs, questionnaires.	Texaco, Inc, a Fortune 50 company. An automation team with corporate ITD. This was part of an overall TQM project.	14 teams consisting of 5 members	Tactical: implement automation tools in the corporation's data centers.	Weekly meeting over 15 months.
Vogel & Nunamaker, 1989	GSS: PlexCenter, Level 2, Decision room, Facilitator, Anonymity, Tools: EBS, Issue analyzer, Topic ranking, SIAS, Training: 15 min.	Case study. Data collection: ideas generated, comments	Health care group.	13 management & administrative & CEO	Strategic Planning: systems and processes open to the organization.	2 sessions; 3.5 hours each one week apart.
Vreede, 1996; 1998	GSS: GroupSystems, Level 2, Decision room, TeamGraphics; Arena simulation language Anonymity, Facilitator: Tools: Topic Commenter, idea organizer, group outliner; Training: ?	Action Research. Prototype, surveys	Government organization: Criminal Investigation department (CID) of the Amsterdam Municipal Police Force. Netherlands.	1 Group; Subjects per session—4,4,8,12,12 Total subjects: 27; unique stakeholders; Professionals; 40 participants	Strategic and organizational change (BPR)	5 sessions; 2 at 3 hours and 3 at 6 hours
Vreede, Briggs, Duin, & Enserink, 2000	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: EBS, Categorizer, Training ?	Theory: Brainstorming productivity: blank slate (decathlon) versus sequential ideas (relay). Field study Questionnaires, session logs,	Construction project: choice between two designs. Netherlands.	10 groups; 100 participants	Strategic and tactical planning.	10 sessions, length not reported

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Vreede & Bruijn, in-Press; Bruijn & Vreede, 1999	GSS: GroupSystems, Level 2, Decision room, Facilitator, Anonymity, Tools: Basic set, Training?	Action research Data collection: questionnaires, interviews and observations.	Multiple organizations Netherlands	9 groups; 4 to 15 subjects per group; 61 total subjects; Professionals	Strategic and operational tasks.	1 to 4 sessions; one half day to 1 day in length.
Vreede & Dickson, 2000	GSS: GroupSystems, Level 2, Decision room, Anonymity, Tools: EBS, idea organization, Vote, Alternative evaluation. Training ?	Action research Data collection: session logs, questionnaires, and interviews	Amsterdam Municipal Police Force, Netherlands.	8—14 subjects representing the information department	Collaborative business engineering: develop the approach to reorganize the Criminal investigations department to better deal with organized crime.	7 sessions, seven hours each over 3 months. The entire project took one year. Several development sessions were also used.
Vreede, Jones, & Mgaya, 1998; 1998-1999.	GSS: GroupSystems, Level 2, Decision room, Tools: categorizer, vote, Training: ? GSS were usually portable, Often shared machines	Technology Acceptance Model and interpretive/grounded theory; Field Studies. Method—qualitative + quantitative, including open and semi-structured interviews, logs of meetings, observations during the meetings and interactions with stakeholders; post meeting satisfaction questionnaires in Tanzania.	Culture—East and South Africa, former British colonies Malawi, Zimbabwe, and Tanzania.	11 groups Participants included stakeholders from a variety of governmental bodies, civilians, and other relevant sectors (e.g., World bank).	Idea generation and evaluation on "capacity building" participatory development projects, including environmental planning, new computer system planning, World Bank projects, etc. Treated strategic and operational issues.	11 meetings over two years, one per group. Some were 2-3 days long.

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Vreede & Muller, 1997	GSS: GroupSystems, Level 2, Decision room, Anonymity, Facilitator, Tools: not reported, Training:?	Case Study Three cases selected as having 'bad" (low success) meetings. Data collection: Questionnaires, session logs, and interviews.	Three cases: 3DOME—a consortium from academia and business; The Vice Case—a multi disciplinary police team; The Climate—a diverse group of industry & government representatives Netherlands	3Dome—5 to 9 subjects; Vice—8 subjects; Climate—10 subjects	3Dome—Internet service; Vice—municipal policy; Climate—Climate control	3Dome—6 meetings; Vice—1 meeting; Climate—2 meetings; Session length not reported.
Vreede & Wijk 1997	GSS: GroupSystems, Level 2, Decision room, Facilitator, Tools: Not reported, Training?	Action/field research. Surveys; interviews with meeting initiator and some participants; expert estimation (e.g., of hours that would have been required w/o GSS); direct observation; system logs. Data were collected before, immediately after, and well after the session.	National Nederlanden Insurance, a large organization. Netherlands.	Subjects: total of 91 employees or independent agents; mean group size 10.1. Mostly first time users of GSS.	Variety involving medium to high structure, high importance	9 single sessions, 2 in decision room, 7 in portable condition
Walczuch, Watson, Bostrom, & Day, 1995	GSS: Vision Quest, Level 2, Decision room, Anonymity, Facilitator, Tools: EBS and voting, and PRISM, a single user implementation of Interpretive Structural Modeling Training—practice ("fun") problem	Case study, Data collection: Questionnaires, Observation, Nine structured follow up interviews, including repeat of pre-meeting Cohesion Questionnaire	Organizational Context U. of Georgia Housing Dept., Size professional staff of 22	1 group; 14 subjects; managers and professionals; from two different divisions of the housing organization	Task: identify problems with organizational processes and find process improvements	3 meetings over 3 months

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Zigurs, DeSanctis, & Billingsley, 1991	GSS: SAMM, Level 1 Decision room, Anonymity, Tools: Ranking, Voting; Training: Practice problem.	Case study. The intent was to observe and measure system usage.	Communication course assignment	8 groups; 4 or 5 subjects per group. 37 total subjects. Undergraduates in a communication course.	The University Goal Task as practice; The Foundation Task, Strategic planning; Type 4	8 two hour sessions over two months on two tasks
Zigurs & Kozar, 1994	GSS: TeamFocus, Level 2, Decision room, Tools: EBS, voting, topic Commenter, policy formation, Idea organizer; Training?	Case study. The intent was to measure and observe the GSS environment on role perceptions of initiators and participants.	Organization IBM in Boulder, Colorado	10 groups; 7 to 15 subjects per group; 100 total subjects; professional	A "real" organization task; Judgmental decision making; Type 4.	1 session, length not reported.
EIES Field Trials	The original EIES field trials, sponsored by the National Science Foundation, followed eight scientific research communities through two years of system use. Most of the communities did not have specific tasks that they set out to accomplish, but rather were devoted to the discussion of theoretical and methodological issues in their disciplines. The three online communities that had a specific task are included here.					
Johnson-Lenz, Johnson-Lenz, & Hessman, 1980	CMC: EIES, Level 2, Distributed, Asynchronous, Facilitator/leaders, Tools: DSS, Terms, and voting, Training: Yes, Quarterly face to face meetings.	Field Study: Observation and online Baseline and follow-up questionnaires, interviews; system use statistics	JEDEC Study: Representatives of electronics industry companies	77 total invited members in 8 overlapping activities; 58 participated	Design and agree on new product standards to be recommended for official adoption by ballot.	20 months duration; mean of 74 sessions totaling 22 hours online.
Johnson-Lenz, Johnson-Lenz, 1980; Lamont, 1980; Stevens, 1980	CMC: EIES, Level 2, Distributed, Asynchronous, Facilitator, Tools: Special Topics templates and roles structures to limit, filter and order communication, Training?:	Field study: Observation and questionnaires	LegTech-EIES Study: Government and Not for Profits	One, 24 in initial period; later expanded to 80. State legislative scientific advisors and liaisons from scientific societies.	Provide scientific information to state legislators, on request.	Participants involved for 6—18 months at time of study.

Appendix 2: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Methodology (Continued)

Authors	Technology/Media Used Study Type	Theory/Data Collection Methods	Organizational Context/Nation	Groups	Task	Sessions
Bernstein, Siegel, & Goldstein, 1980; Siegel, 1980	CMC EIES; Level 2, asynchronous, Facilitator. Tools: tailored "Terms" software to search and to vote, with simplified interface	Field study: observation and questionnaires	NLM-Hepatitis Study: Medical researchers, working on National Library of Medicine project	One, ten M.D. experts plus facilitator and NLM staff	Update and validate by consensus, contents of NLM database ("knowledge bank") on viral hepatitis, including reviews of 850 new papers.	7 months. Hours online varied from 4.5 to 66.
IBM Studies						
Grobowski, McGoff, Vogel, Martz, & Nunamaker, 1990 McGoff, Hunt, Vogel, & Nunamaker, 1990 Martz, Vogel, & Nunamaker, 1992 Nunamaker, Vogel, Heminger, Grobowski, & McGoff, 1989 Vogel, Nunamaker, Martz, Groboski, & McGoff, 1990	GSS: GroupSystems, Level 2, Decision room, Facilitator, Anonymity, Tools: EBS, Issue analyzer, Vote, Policy formation, Training	Field study Data Collection: questionnaires, interviews, observations, comparisons of projected and actual man hours.	Organization: IBM manufacturing plant Size: 6,000 employees; upstate New York	59 cases; 8.27 subjects per session Total subjects: 490 Professional	Manufacturing tasks (shop floor control)	Number of sessions: 199 session hours Session length: avg 3.37 hours; Number of sessions: 29.

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results

Author	Results	Comments	Conclusions
Adelman, 1984	The DSS facilitated: 1. by allowing normative approaches to decision making 2. permitting real time sensitivity analysis 3. providing a mechanism for group discussion	The results suggest that the group based DSS aided in improving effectiveness, and efficiency of the group. The task was implemented one week after the second set of meetings. The DSS tools improved discussions by letting the decision makers focus on the model and not each other, resulting in better discussion.	
Adkins, Sheare, Nunamaker, Romero, & Simcox, 1998	GSS supported strategic planning improved the quality of the plans, reduced time (8 vs. 17.7 hours) , and increased satisfaction with the process. There was no significant increase in the level of commitment to implementation between the GSS and non-GSS groups.	GSS allows a much larger number of personnel to be actively involved in the planning process and thus results in a higher quality product. GSS groups also had a greater number of ideas generated than did non-GSS groups	GSS technology improved the quality of the strategic plans, reduced the time to completion, and increased the process satisfaction.
Alavi, 1993	Idea generation time: GSS took less Number of ideas: GSS more Idea quality: GSS better Prioritizing time GSS took less Comfort participating: GSS better Stress: GSS less stress Usability: GSS better Use the GSS again: GSS better Cohesiveness: GSS better The group worked well: GSS better The results are evaluated in comparison to a traditional meeting.	A substantial level of discussion and information sharing was observed. In addition to the exchange of ideas and information electronically, a relatively high level of verbal communications took place. The electronic channels seemed to augment and stimulate verbal discussion, rather than replacing it. Participants said they felt more comfortable in offering their ideas and perceived less stress during GSS than in FtF meetings.	The GSS users felt that relative to traditional FtF meetings, GSS leads to the generation of more high quality ideas, in a shorter time period. The GSS participants were also more satisfied with the meeting process and had a higher level of cohesiveness.
Bikson, 1996	1. Meeting objectives were met 2. A facilitator is important 3. The participants believed they had more impact on the outcomes compared to other methods 4. Improved knowledge, knowledge sharing, and understanding 5. Increased participation 6. Anonymity- positive effect on divergent thinking: broadens participation 7. Parallel input was an important feature 8. GSS sessions save time, add to comprehensiveness, accuracy, and quality	A high level champion was not part of the implementation- it came from the ORG department. Repeated business accounted for a significant demand for the GSS room. The GSS had limited used in decision making due to: the culture at the World Bank; very complex analysis and decision making processes at the Bank; They suggested spaced rather than massed sessions to avoid potential buy-in regret.	GSS meetings were vastly more efficient than non-supported meetings and improve the quality of the results. Positive outcomes result from pre-meeting planning and training, a good meeting plan and well defined objectives, and a facilitator.

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
Briggs, Adkins, Mittleman, Kruse, Miller, & Nunamaker, 1999	**Lessons Learned** 1. Infrequent ad-hoc use hinders self-sustenance 2. Find a specific, repeated process to support with GSS 3. For continued ad-hoc use a GSS specialist is required 4. Keep the process simple	Pre-meeting plans are vital; Compare GSS results to alternatives; Typing does not interfere with the results; Usefulness is important, but pay attention to: social, political, physical and cognitive factors; Usefulness varies with time pressure.	The results suggest that ad-hoc problem solving hinders the transition process. Furthermore, GSS sustainability requires structured repeatable processes. Longer term aim is to have distributed portable use.
Caouette & O'Connor, 1998	Team A was committed to the task, and started with GSS; its members were very positive about the value of GSS. In the afternoon, without GSS, it somewhat fell apart. Team B started manually. Its leader did not understand the technology or her role. Team B did not perceive any added value from the system. 1. Do the stages occur in the same order and intensity when teams are augmented with GSS? Yes, the GSS can help a group get started. 2. Does GSS allow teams to handle conflict better? Yes, GSS reduces conflict time. 3. How do group characteristics impact team development, with and without GSS? The groups developed differently. Leadership is an issue. 4. Does task complexity interact with perceptions of the value of GSS? Yes.	"Effective decision making may be dependent on a group's ability to work as a team. Therefore, the process that groups go through in becoming a productive, functional team is an important issue to explore in organizations that rely on high-level GSS as a group communication tool." GSS can help a group get started (forming), but only when the group considers the task to be solved important. When any team gets off to a good start, good work begets more good work (performing).	GSS reduced the amount of time and the number of times that teams were in conflict (storming). Teams using GSS spent more time ensuring that they were together on the task (norming). Closure was also more apparent (adjourning). The two teams developed quite differently and GSS impacted all stages, most noticeably the storming stage. The commitment of the teams to the task, group composition and leadership were identified as moderating factors.
Carmel, Herniter, & Nunamaker, 1993	System usage total 23% (16% in EBS and 7% in Contract Log); 77% of the time the two groups used verbal communication. There is evidence that the GSS enriched the communication process and cooperative work.	The sessions were categorized into three stages: strategy, Issues, and bargaining. The Union and management teams each had separate strategy meetings.	The results of the case study suggest that the four components (GSS, mediators, structured process, and setting) contributed toward the contract negotiation. No single component dominated.

Author	Results	Comments	Conclusions
Corbitt, Christopolus, & Wright, 2000	1. Accomplished more with a GSS than FtF methods: Yes 2. GSS is effective for BPR 3. Honesty, commitment, openness improved across sessions 4. GSS increases the number of ideas 5. Computer confidence improves across sessions 6. Improved efficiency.	The authors suggest that the GSS tools make the BPR activities effective and successful.	The results suggest that by using a GSS to support BPR the design is accomplished more effectively and in a shorter period of time than with previous methods.
Davison, 2000	1. 54 comments on 7 topics after session 1 2. 101 comments on 2 topics after session 2 3. Increased participation	The use of Email to collect and communicate ideas worked well. The project was abandoned after two GSS sessions. Considerable task focus problems were encountered	System failure due to: lack of an authoritative manager; an extremely complex task. It was also suggested that the lack of an interdisciplinary team (including a librarian) may have helped.
Davison & Vogel 2000	1. Participants not highly motivated (they could not charge their time to any project or client). 2. The participants were not interested in the task. 3. Anonymity was used incorrectly. 4. Facilitator and CIO were at odds. 5. Team members perceived system as good for idea generation, but GSS not so good for developing consensus or deciding upon fine points of detail 6. GSS did exert a positive influence on the meeting process.	Participants challenged the anonymity of the GSS; were afraid of loss of confidentiality. . CIO "misappropriated" it, using it as one form of dominating proceedings, entering many ideas and "sometimes submitted wild or provocative ideas so as to see what he could get away with." Facilitator/researcher had conflicts with the CIO over meeting dominance.	The GSS functioned as a team memory. "Culture of cautiousness hampered the situation; female members in particular were perceived as not willing to contribute ideas if they were unsure of their accuracy. 'GSS can be effectively used for longitudinal meeting contexts so long as the GSS facilitator employs the technology flexibly.
Dean, Lee, Orwig, & Vogel, 1994; 1995	1. What features of group modeling are important to effectively support group modeling meetings? EMS supported groups produced 251% more activities and 175% more ICOMS per day. Individuals in EMS supported groups were also more productive. 2. Can GSS modeling tools and methods allow a larger number of participants to contribute resulting in faster and more efficient model development? A greater number of participants do get involved. 3. How does the quality of structured models developed with GSS-IDEF compare to traditional meeting support? Quality measures: generally not significantly different.	This paper talks about the evolution of the tool as a result of the evaluation of the field trials. The EMS supported modeling appears to increase the number of subject matter experts who can be directly involved, and allows models to be built significantly faster because of parallel contributions and increased efficiency. The evidence suggests that this results in more extensive and complete model descriptions. On a number of style indicators, MMS based models are comparable but there are a few areas where manually supported models scored higher on style and semantic quality, particularly in model integration. By decreasing the time needed, EMS supported modeling also reduces the cost required to develop business models. Larger number of active participants should improve "buy in" and perceived legitimacy of the model and thus help in using them as vehicles for implementing improvements.	
Dennis, 1994	Method Perceived effectiveness: GSS > FtF Perceived satisfaction: GSS > FtF Perceived efficiency: GSS > FtF	The results suggest for larger groups performing idea generation tasks, meetings with a greater proportion of electronic communication were perceived to be more effective, efficient, and satisfying.	The greater the use of electronic communication as a meeting component the more effective, efficient and satisfying it is.

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
Dennis, Daniels, Hayes, & Nunamaker, 1994; 1994	Comm Mode Productivity: GSS > FtF Number of ICOMs: GSS > FtF Development time: FtF > GSS Content quality: Ns Style quality: Ns	GSS groups averaged 17 subjects per group versus 8 for the FtF groups. The traditional IDEF models took 6 weeks to complete versus 1 week for the GSS groups. Both methods used facilitators; the GSS facilitators did not act as an intermediary. The EBS portion of the process enabled all participants to contribute equally.	The use of GSS techniques and processes can significantly decrease the time, and thus the cost of complex actual IDEF models. GSS-IDEF participants spend more time concerned with content than on model appearance.
Dennis, Hayes, & Daniels, 1999	Efficiency: GSS > FtF (took less time) Quality: No significant differences Perceived Quality: GSS > FtF	Groups using GSS-based modeling processes and tools develop models 4.5 times faster than groups using traditional process and tools. Traditional models take a median of 6 weeks to complete versus one week for GSS groups. The GSS modeling tool and process enables the groups to better integrate the model components among the subgroups. Parallelism of the GSS provided the group members the opportunity to propose changes to the model. The GSS groups also did not waste time discussing minor issues.	
Dennis, Heminger, Nunamaker, & Vogel, 1990	1.Can GSS support planning by a large group? Yes 2. Can GSS provide both structure and flexibility? Yes 3. Can GSS process be efficient? Yes 4. Can GSS be effective? Yes 5. Can GSS be satisfying to the participants? Yes 22 of 26 believed that the automated process was better than a manual one. Flexibility was introduced to change the agenda and tools as needed. Participants generally found the process effective, citing anonymity, which "allowed people to ask questions that would not have been asked if names were tagged to the questions", and participation among many more participants than would otherwise have been possible. All participants were in the neutral to agree range on whether the EMS supported process is better than the manual process.	Initial comments are entered quickly (about 12 comments per minute during first 10 minutes of an hour session), dropping to 4 comments per minute.	This study shows that GDSS can be successful for large groups. It successfully provided both structure and flexibility; was effective and efficient, and satisfying to users. The company elected to use the system again in subsequent years.
Dennis, Nunamaker, & Paranka, 1991	Observation and survey results. GSS meetings are better than FtF – Yes; GSS helps in idea generation over FtF- Yes; GSS more efficient than FtF- Yes; GSS has higher satisfaction than FtF- Yes.	Groups seem to require that there is a sense of commitment towards the outcomes of the meeting.	The results suggest that EMS has the ability to help in the rapid collection of ideas. The structuring techniques both for conduct of the meeting and the analysis of the issue contribute to the success of the meeting.

Author	Results	Comments	Conclusions
Dennis, Tryan, Vogel, & Nunamaker, 1997	**Information Production & Identification (IPI)** Process support- positive Process structure- positive Task support- No effect Task structure- No effect **Information Communication & Integration (ICI)** Process support- positive Process structure- Marginal positive Task support- No effect Task structure- Positive **Flexibility & Leadership (FL)** Process support- No effect Process structure- No effect Task support- No effect Task structure- Positive	All but one organization used process support tools. Anonymity was seen as the most important by 14/30 of the organizations. The participants suggested that anonymity improved the quality of the meeting. 17 organizations stated that process structure (role of facilitator) was important. 20 organizations used task structure tools (Topic Commenter). Task support tools (external databases, etc.) were not used very much. Many organizations brought in their reports.	The results suggest that organizations that make extensive use of process support (parallelism, anonymity, & group memory) rather than chauffeured show improved IPI and ICI. Organizations that made more use of process structures (i.e. meeting agenda) improved IPI. Organizations that made greater use of task structures improved ICI and FL.
DeSanctis, Poole, Dickson, & Jackson, 1993	**Team 1** / **Team 2** / **Team 3** **Inputs**: good task tech fit / Low task tech fit / Low fit Openness to use SAMM **Group Process interaction**: Appropriation- high / variable / high Distribution uneven / uneven / uneven High use of EBS Used low level communication Low participation / low / high **Outcomes:** Efficiency- mixed / low / moderate Effectiveness- Good / some gains / good to high Consensus- poor Comfort- good	All of the teams used the GSS and used it primarily for task purposes. The teams used the GSS to display agendas, record information and these tools provided continuity from one meeting to the next. Decision quality was improved when the GSS was used. Appropriations varied across the teams and were dictated by the nature of each team's task and commitment to TQM. Contingency theory would predict that task-tech fit accounts for GSS effectiveness. However, team 3 had the lowest Task-tech fit and the highest success with the GSS.	

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
DeSanctis, Poole, Lewis, & Desharnais, 1991; 1992	1. Extent of use: Teams who started using the GSS early were more likely to continue to use the system; Meetings per month: 20.6. 2. Types of features used: ; Level 1 and Level 2 technology was used; Facilitators accompanied most sessions; Level 2 technology was used more than level 1. 3. Satisfaction with SAMM: Comfort & enjoyment; Provide the right support 4. Initiation of use: Group leaders and outside facilitators 5. Instrumental use: SAMM primarily was used for task purposes. 6. Use sentiments: There was a balance between positive and negative sentiment towards SAMM.	Patterns of use varied. Infrequent users had lower satisfaction and comfort than more frequent self-initiating user.	Over the seven month period of time system use was relatively high, primarily for task and process related activities. The initiation to use SAMM came mostly from the group members themselves. Self reports of satisfaction with the technology were high.
George, Nunamaker, & Valacich, 1992	1. The GSS helped to increase participation levels, because it allowed the group to work better together. 2. The GSS improved the outcome.	This paper is an early case study using GSS technology. The authors discuss what it took to implement the GSS and that was a strong champion and no cost.	The results suggest that this was a success because the systems was adopted and implemented for a short time and later returned. Key factors were: lack of use, lack of a continued champion

Author	Results	Comments	Conclusions
Genuchten, Cornelissen, & Dijk, 1998	Dependent measures (Descriptive or relationship results) Effectiveness is number of defects found per inspected page. Meeting effectiveness is the number of (additional) defects found per page during the logging meeting. The effectiveness of the EMS supported inspections is considerably higher than for traditional meetings. The preparation effectiveness was also higher-preparation effort was higher when list had to be submitted in advance. Ratio of preparation to meeting effectiveness was much higher for EMS meetings (e.g., 13 vs. 3 to 1 ratios). Efficiency is the number of defects found per person hour invested in the inspection. Efficiency much higher with EMS. Yield is the % of defects found during the inspections vs. the % that slipped through and were detected during later tests or in the field . However, subjective opinions of the EMS were less favorable than in previous lab studies. e.g., mean of 3.7 out of 5.0 for "satisfied."	It was found that the group resented spending time as each person typed in their individual errors identified. From the second meeting on, they sent their individual defect list in ahead of time, and it was entered into the system before the EMS began. The meeting was considered less stressful than traditional logging meetings. A Fagan inspection is a structured review aimed at detecting defects in development documents or code. It consists of individual preparation in which each participant independently lists apparent defects; a logging meeting for group to merge, compare, and add to list, then fixing of the documents. The effectiveness and efficiency of the logging meeting are typically low compared to the individual preparation, when logging meetings are traditional FtF.	EMS support of software defects logging meetings can improve the effectiveness and efficiency of the process. The fact that inspections are routine meetings with a clear structure differentiates them from the typical EMS meeting. This imposes new requirements such as; facilitator is superfluous; participants know what to do. Also, such small frequent meetings cannot afford a separate facilitator. Also setup time for tools for EMS has to be minimal for routine meetings. Less favorable reactions of subjects than in previous lab experiments with EMS may be due to the fact that inspections are already a very structured process; in other kinds of meetings, the EMS often brings the benefit of improved preparation and structure. An inspection as a structured process could benefit from fixed-format input fields incorporated into the EMS, rather than free form input.
** Herik & Vreede, in press	Case 1: the project organization was too complex. Voting on the items did not seem to really build consensus on what is important. The participants were very dissatisfied with the available time for discussion. "We have generated more information, but it is considered less carefully." But, the final report presented two years later, did include the models that were used in the GSS sessions. Case 2: GSS was felt to enhance the efficiency and creativity of the meeting, but was felt to be unfit to support discussion, either electronically or verbally. Satisfaction with using GSS= 4.1 /5, but support of communication only 2.9/ 5. Opinions on the use of anonymity were mixed but generally positive. Six months later, this project was folded into another one.	Policy making is defined as "the process of constructing a politically supported plan to achieve desired societal change." Anonymity seemed to hinder discussion in this long-term group. "Group support for policy making is a difficult endeavor." The process of idea generation, visual modeling, and the availability of anonymity appear to be highly successful in a multiple stakeholders environment, whereas a lack of expression (media richness) the voting facilities and reaching consensus when views conflict, are evaluated less favorably. Longitudinal research reporting long term impacts is necessary. Policy agendas should contain both divergent and convergent activities. GSS, though suitable for 'quick and dirty' idea generation, is less useful for the in-depth discussion required for complex policy debate. Voting tools do not generate consensus in heterogeneous groups.	

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
Hiltz & Turoff, 1991	All groups scored well on "critical success factors" and all completed interim and final reports on time. Participants felt satisfied with the system (perceived it as stimulating and enjoyable); that the quality of the output was high, and that they saved time compared to what would have been required to produce the reports and recommendations otherwise.	Perceived information richness of the medium was strongly correlated with perceived productivity enhancements as a result of system use.	
Iacono & Weisband, 1997	Team performance: 6 high performing and 8 low performing teams. Diversity of teams unrelated to success. Access: Having 2 or more members with a modem at home significantly related to report quality ($p<.05$). Ability (GPA) and quality: no relationship. Age and quality: high performing teams older (26.3 vs. 23.8, $p < 05$). Previous experience: no relationship. Both Work process and Work Content initiations and responses positively correlated with team performance; as were total initiations and responses. High performing teams had more "fun" interactions. Peaks of interaction driven by project deadlines for each phase. High performing teams had more early initiations to find partners and quickly form teams (day 3 vs. day 7 peak) , and more effort in the final phase.	"Once involved in an interaction, participants must actively respond by signaling their involvement and by doing what is requested of them. We conceptualize this active interaction as initiations and responses. Initiating an interaction by asking a specific question or making a proposal implicates the receiver in generating a relevant response... But to initiate interaction requires trust. Each individual initiation is an enactment of swift trust, contributing to the collective perception that trust is reasonable, inspiring more trust and more initiations from other members of the group. If initiation of interactions is part of doing trust work, so, too, is generating the relevant responses . A response indicates to the initiator (and everyone involved in the interaction) that the receiver has done her obligatory part. Consequently, the making of responses signals and inspires trust in the group" (p. 413). "Continuous interaction among team members fosters trust and predicts team performance." High performing teams quickly began to form teams, and were able to handle several activities at once. Most intense efforts were several days before each deadline instead of at the last minute (or not at all) (p. 419).	
Jarvenpaa, & Leidner, 1998	Teams with high trust encouraged each other, took initiatives, were enthusiastic in language, and responded to each other, early on. Inequitable, irregular, and unpredictable communication hindered trust. Teams ending with high trust gave substantive and timely responses to one another. Of 14 teams that started with Low trust, 10 stayed Low; of 15 that started with Hi trust, 10 stayed Hi. Appointed leaders of Hi-Lo teams engaged in negative rather than positive reinforcement.	"Swift trust" is based initially on clear role definitions to form initial expectations, and is then built and maintained by "a highly active, proactive, enthusiastic, generative style of action; action strengthens trust in the group in a self-fulfilling fashion."	
Kock, 1998	Choice of medium: Electronic > FtF and phone 76.2% versus 23.8% Medium limitations: Electronic had higher ambiguity than FtF and phone. Adaptation: Electronic > FtF and phone Response times: Electronic contributions were slower than FtF contributions. Size of communication: Electronic > FtF Decision quality: Electronic > FtF	There was a perceived increase in member contribution quality through the electronic media. The author suggests that adaptation to electronic communication led group members to prepare longer and better thought out contributions than in FtF settings.	The results suggest that the process improvement groups implemented their proposals which resulted in increased quality and productivity. This resulted because the groups adapted to a leaner medium (electronic CMC). The results also suggest the CMC can be used for equivocal tasks.

Author	Results	Comments	Conclusions
Kock & McQueen, 1998; Kock, 1997	Cost: 78% felt that email conferencing decreases the cost of running process improvement (PI groups, through (a) reduction in disruption of member functional activities in their jobs; (b) a drastic reduction in transportation and communication expenses in groups involving members based in different cities; and (c) considerable reduction in member participation time (65 to 92%). Effectiveness: 33% felt conferencing increased effectiveness, 33% no difference compared to FtF, 17% thought it Decreased. Those who thought effectiveness increased cited improvement in the quality of individual contributions fostered by the written asynchronous medium. Group interaction: fewer turns but longer contribution length per turn (mean of 260 words online vs. 40 per turn FtF). 1. CMC support enables group discussions to be carried out without effecting individual timetables 2. CMC support reduces the influence of distance 3. CMC reduces the influence of previous interdepartmental conflict 4. CMC improves the way members interact- more sincere 5. CMC encourages members to write better.	There was considerable lag between leader's questions and group response, ranging from under an hour to more than 8 days; mean was 73 hours. This means group leaders would typically have to wait about 3 days for replies enabling them to proceed further. The usefulness of asynch may increase with the number of depts. involved in a group. Five of the groups were successful in generating and either fully or partially implementing process redesign proposals. "While not having negative perceived effects on group effectiveness, asynchronous groupware support was perceived as increasing process adoption, hierarchy suppression, departmental heterogeneity, and contribution length, and decreasing discussion duration, cost, and interaction in process improvement groups." While synchronous GDSS groups are often associated with an increase in the quantity of ideas generated by the group, asynch seems to be related to an increase in group process adoption and discussion focus, increase in quality of contributions, and a drastic decrease in group set up costs.	
Krcmar, Lewe, & Schwabe, 1994	Case 1: Social club- GSS tools not used, Case 2: BPR-Anonymity very important; over time (1 day) the group became more committed; More ideas were generated; difficulty structuring the ideas; Improved productivity. Case 3: Review- The facilitator was the most import process; Anonymity was important; Parallel work most important; More equal participation	Facilitation is essential in convergent group phases. The facilitator must act very carefully- participant are not in favor of heavy facilitation. The usefulness Anonymity was mixed. Parallel processing was the most important benefit. The most consistent observed benefit was equality of participation.	
Lewis, Keleman, & Garcia, 1990	Ease of use Positive Comfort Positive Efficient Positive Effective Positive Productive Positive Better than FtF Positive Process Satisfaction Positive Solution Satisfaction Positive Willingness to use it again Positive Recommend GSS Positive	The authors suggest that consultants/ facilitators should be available when dealing with unstructured problems, and when the groups are not experienced with the process, tools, and group dynamics. Training is also crucial to the groups performance. There are significant interactions between the group, task, and settings.	The results suggest that the GSS was favorably viewed by the groups.

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
McCart & Rohrbaugh, 1989	On follow up, 5/14 groups were very positive about benefits, 5 not positive, and 4 intermediate. Two major benefits of decision conferencing: location away from office, and presence of facilitator. Five characteristics explained variance in perceived benefits: 1. providing an opportunity for open and extended discussion 2. Building a computer based decision model 3. Reviewing computer output on implications of alternative choices 4. Construction of an action plan to be implemented and 5. Firmly believing that the problem would be resolved by the end of the conference. Decision conferences were not successful when these five benefits had not been fully realized. Perceived usefulness of the model was the strongest predictor.	Differences in perceived conference success were related to (1) the proportion of participants who believed the conference resulted in a decision and (2) the level of benefits derived from full support of the structure or preference technology, including full discussion of the decision models and an action plan. Decision conferences fail when these benefits are not provided. For instance, the group many squander so much time building a model that they do not use it. An inappropriate devotion to the use of information technology may substantially reduce the opportunity for open and extended discussion.	
Markus, 1992	2 of the 4 teams did not use internal electronic messaging. Interviews suggest that the primary reason for joining the project was to get the word processing software. The two teams which adopted the technology, primarily communicated between two people.	Synchronous use of the technology came about due the need of one group to convert from 5 ¼ to 3.5 inch disk media. This is AST.	Adoption and usage patterns differed across the four groups. Not all groups adopted the technology, for those that did not all members participated. External messaging was used more that internal messaging. Groups utilized the technology to overcome geographic distance, media incompatibilities, and poor group relations.
Morales, Moreira, & Vogel, 1995	GSS applicability to participants job: more agree 47.3% FtF communication is better with a GSS: More disagree 49% GSS helps the group integrate better: more agree 86.7% Group participation is better with a GSS: More agree 44% Quality of results was good with the GSS: More agree 96%	Mexican participants tend to be more expressive and tended to comment on opinions of others more than Americans, whereas GSS tends to encourage brevity. GSS tends to promote collective behavior and should thus evoke comfort among Mexican groups because they are on the “collectivism” vs. ‘individualism” end of the cultural values scales.	Overall, the results suggest that Mexicans can benefit from GSS. GSS assisted the participants to enhance inter-group communication and integrate information. GSS application in Mexican contexts is often more flexible than with US groups. Because of relatively high power distance effects, Mexican cultures would be less comfortable in anonymous GSS contribution.

Author	Results	Comments	Conclusions
Nunamaker, Applegate, & Konsynski, 1987:1987	1. What are the dynamics of an EBS session? Entering comments- 57%; waiting for screen- 12.6%; reading screen- 27%; group interaction- 3.4% 2. How does the technology facilitate the idea generation process? Comments suggest that it is improved. 3. How does the technology inhibit the idea generation process? The interface, typing, and waiting for the next screen all inhibited the process. 4. What is the reported satisfaction of the planners using the GSS? High levels of both outcome and process satisfaction were reported.	The users focus on the task and the GSS with very little interaction between the participants. EBS appears to decrease inhibition. The GSS allowed for more equal participation.	The results suggest EBS process outweighs other obstacles. In addition, the users report high levels of satisfaction with the outcomes and rate the GSS as an important tool for idea generation.
Post, 1992; 1993	Observations and measures Effectiveness- dollars saved: $432,260 Efficiency- labors hours saved: 71% Consensus generating: Yes Improved decision making: Yes Comfort: Yes. Willing to use the system again: Yes.	The results of the surveys suggest that the organization can reap significant benefits from the technology.	The results suggest that GSS technology appears to be most valuable when it is deployed and integrated into organizational decision making environment that is both dynamic and complex.
Quaddus, Atkinson, & Levy, 1992	The multiattribute decision model (MADM) was used to compare with weights the differences between current strategies and reorganized strategies. The results revealed that 9 reorganized strategies out of 15 strategies were preferred. An action plan to implement these strategies was then developed.	The authors suggest that the major benefits for the group were: • Agreement on strategic direction • The process enabled the groups to remain focused • Conflicting opinions were more easily dealt with • The important issues were easily surfaced • A shared understanding developed • Facilitation played a major role	
Sheffield & Gallupe. 1993; 1994; 1995; 1995	Observations from Case Study Effectiveness: Yes Effectiveness of facilitation: Yes Effectiveness of technology: Yes Reducing barriers: Yes Participation: Equal Information exchanged: Improved Meeting outcomes: Effective Average effectiveness: Effective	The authors suggest that the meeting technology supported the economic development process where meeting urgency and efficiency were of prime importance. All observations are perceived.	The main finding of the follow-up study was that the initial meetings were a catalyst for cooperative action for the industry participants. The participants felt that the intensity of the meeting process, the EMS, the model, and the large number of participants resulted in long-term success.

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
Vician, DeSanctis, Poole, & Jackson, 1992	Systematic processes: Improved over time Openness of communication: Improved over time Comfort with technology: Improved over time Member attention and Interest: The GSS support this GSS improved negotiations- ranking and rating activities GSS improved participation GSS enhanced communication GGS help in sense of accomplishment over time	The authors suggest that the team members seem to have gained a favorable sense of accomplishment as time progressed. Typically the scores were low in the early period (after 5 meetings).	The effects of the GSS and TQM approach were subtle. The technology does not bring revolutionary advancements toward the goal. Leadership is important: 1) commitment on the part of the leader to the principles of participation; 2) perseverance in continual learning and application of the technologies over time.
Vogel & Nunamaker, 1989	Effectiveness: Idea generation-11 pages, 650 lines of ideas in 40 min. Issue analyzer-over 100 focus items identified in 45 min. Issue consolidation-13 items condensed from 100 in 45 min. Efficiency- The groups suggested that this would normally take 2 days to complete.	The authors concluded that: 1. Anonymous session are important-promotes honest and thoughtful. responses from the group members. 2. Efficiency-parallel input of ideas. 3. Flexibility-the software can configured to meet the needs of the group. 4. Enhanced group dynamics- equality of participation. 5. Electronic memory-all comments are recorded.	
Vreede, 1996; 1998	GSS Technology- Positive results: Quantity of session results Greater productivity than manual meetings High quality Usability Collaborative Design Process- Positive results Satisfied Agreement Enjoy Usability	This technology was compared to other methods and the results were all positive:	Stakeholders built conceptual models and models for change using the technology. The GSS technology made the collaborative activities more efficient. GSS technology and animation technologies are complementary in BPR.
Vreede, Briggs, Duin, & Enserink, 2000	Problem Identification Tasks 1. Productivity: Sequential > Blank slate 2. Unique ideas: Ns 3. Relevant elaborations: Sequential > Blank slate Solution Generation Tasks 1. Productivity: Sequential > blank slate 2. Unique ideas: Ns 3. Relevant elaborations: Sequential > Blank slate	Groups working on problem identification tasks produced significantly higher numbers of ideas than groups working on solution generation tasks. Blank slate participants (decathlon) suggested that there were fewer exchanges of ideas and elaboration. Sequential (relay) participants had no negative comments. No differences in product or process satisfaction were reported.	Sequential (relay) groups make significantly more elaborations than do blank slate (decathlon) groups and produce slightly more unique ideas. Relay participants were significantly more satisfied in terms of interest accommodations than decathlon participants. The facilitator is a strong stimulus for meeting satisfaction.

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Vreede & Bruijn, in-press; Bruijn & Vreede, 1999	Testing GSS Assumptions: 1. the meeting process should be fair- Yes 2. the meeting process should be open- Yes 3. the meeting process should be rational- Little 4. groups should be guided by a facilitator- Yes 5. groups should exchange as much information as possible- Mixed 6. people are cooperative to each other & the meeting process- Little	The authors suggested that the results on the GSS assumptions may be dependent upon the phase of the decision making process (orientation, separation, package deal). The orientation phase appears to be a good candidate for GSS application; the separation phase, poor; and package deal phase has potential for GSS application but with caution. Codes: Yes- there is support for the basic GSS assumption Little- there is only a small amount of support Mixed- there is equal support for Yes or Little	
Vreede & Dickson, 2000	1. GSS sessions improved insights 2. GSS sessions improved consensus 3. GSS sessions improved coordination & participation 4. Positive perception with respect to the information and knowledge elicited during the sessions. 5. High levels of a willingness to work together again (Usability). 6. GSS improved productivity over manual methods 7. Anonymity a key ingredient to the sessions	The system design took 9 months and the planning & analysis took 3 months. The stake holders were satisfied with process, outcomes and the GSS.	The global objective was achieved in addition to an effective design. The GSS supported efficient data collection and model construction activities.
Vreede, Jones, & Mgaya, 1998-1999	Participants were generally very satisfied with the meting process, the technology, and the meeting outcomes. Over 97% of Malawi and Zimbabwe meeting participants said they would recommend this technology; ratings of over 4 out of 5 in Tanzania. Useful results were achieved that were endorsed by participants. In terms of the Technology Acceptance Model, data suggest that top management endorsement, computer literacy, and satisfaction with use stimulate GSS acceptance, whereas a preference for oral communication combined with referent power issues had negative impact.	Logistic difficulties emphasized: frequent power surges or outages, extreme heat shut down equipment, humidity grew mold inside computers. Referent power means that people do not hold a position in an organization based on their skills, but on their contacts. Often, decisions are not based on information or rational interests but on personal relations and favors. Characteristic of this part of Africa. Anonymity interferes with this. Having shared computers with one person doing the input "was a great success" when some participants had no computer or keyboarding skills. In multi-day meetings, handing out hard copy of he work done the previous day was enthusiastically received. Cultural factors influenced use. Relevant external factors that extend the TAM for the African cultures studied include endorsement of top management, computer literacy, oral communication preference (some typed in English but prefer native language for oral discussion), referent power, and satisfaction with use.	

Author	Results	Comments	Conclusions
Vreede & Muller, 1997	1. Anonymity- impeded the quality of information exchange 2. GSS good for brainstorming, but not good for decision making 3. GSS usability- low 4. Process satisfaction- some what positive 5. Focused- low 6. Information overload- Full agenda 7. Communication- negative perceptions 8. Participation- low/poor 9. Facilitator- positive impact 10. Commitment- low/poor 11. Quality lower than manual methods	These were 3 cases selected to be poor. The objective was to find out what they had in common. The results suggest that outcome quality is the strongest indicator of a bad meeting. Explanations: diverging perceptions of the meetings goals, knowledge gap among group members; the use of anonymity may have hindered personal negotiating capabilities.	The results suggest that there are several factors which contribute to GSS meeting failures: overloaded agendas, little discussion time, diverging perceptions of meeting goals, knowledge gaps among the participants, and applying the technology without special provisions in conflict situations.
Vreede & Wijk, 1997	Use of GSS increased productivity by 55% both in terms of man hours and project time span. GSS judged to have increased quality of outcomes. Productivity gains seemed to increase in larger projects. Groups liked working anonymously and in parallel.	The intensity of an electronic meeting seemed to fatigue participants; as a result, some seemed unmotivated to fill out post-meeting questionnaires.	Critical factors to the success of GSS meetings included the translation of meeting objectives into a structured agenda, active motivation of group members to participate, and enough times for groups to digest intermediate meeting results.
Walczuch, Watson, Bostrom, & Day, 1995	No change in cohesion. A positive attitude toward the process prevailed. "The newness of the technology seems to have stimulated group members interest in the meetings." Most managers satisfied with the process, especially the anonymity and the simultaneity of the GSS systems.	Details are provided of the step by step processes used in each of the three meetings.	1. The appropriate mix of group support systems technologies and manual techniques is instrumental in achieving meeting success. 2. Constant review of the overall meeting design contributes to the success of the meting; 1. negative and positive aspects of a meeting should be balanced to provide feedback and encouragement to the group.
Zigurs, DeSanctis, & Billingsley, 1991	Attitudes across groups: Attitudes vacillate across time and task characteristics. Attitudes and quality: Significant correlations with perceived quality. Task participation: Significant correlations with quality and negative socio-emotional behavior. System usage: decreases across time.	The discarded groups appear to be more ineffective and model Hirokawa & Poole's theories. GSS learning follows a cyclic approach.	Usage of GSS varies over time. Groups follow a cycle of experimenting- learning-experimenting. Different groups emerge over time: adopters and discarders.

Appendix 3: Group Support Systems: A Descriptive Evaluation of Case and Field Studies—Results (Continued)

Author	Results	Comments	Conclusions
Zigurs & Kozar, 1994	1. Role perceptions of initiators and participants: ▪ Initiators had no difficulty in identifying the expertise of the participants. ▪ There is a lack of agreement between initiators' and participants' ideas about roles. ▪ Participants had difficulty with identifying their correct roles. ▪ Participants filled a significantly lesser variety of roles than they expected to. ▪ The GSS actually assumed many of the roles that the participants expected to fill. 2. Prescribed roles and perceived effectiveness ▪ There were no significant correlations between perceived effectiveness of outcomes and task roles. ▪ There were no significant differences between effectiveness of process and task roles.	The data suggests considerable mismatches between the role expectation of the initiators and participants. This inconsistency might explain why meetings fail to "behave" and evolve the way they were planned. The role of the recorder was most often mentioned for the GSS. However, the GSS only recorded the typed input and not the verbal communications.	The technology was perceived by participants as assuming roles, some of which were roles they themselves expected to fill.
EIES Field Trials			
Johnson-Lenz, Johnson-Lenz, & Hessman, 1980	System use sped up the standardization process, contributed to better standards by making more information available and providing more discussion opportunities than just quarterly face to face meetings, and better prepared members for the quarterly meetings.	Success of the group directly correlated with time online of the leader/facilitator. System use improved speed and quality of decisions.	
Johnson-Lenz, Johnson-Lenz, 1980; Lamont, 1980; Stevens, 1980	Various members started “spin off” conferences on special topics.	Success of the group directly correlated with time online of the leader/facilitator. CMC said to make information exchange much more convenient for participants in 25 states across 5 time zones. “The combination of access to resources and structured communications capabilities for information exchanges makes a (tailorable CMC) system very promising for meeting the information needs of policy makers on all levels.”	

Author	Results	Comments	Conclusions
Bernstein, Siegel, & Goldstein, 1980; Siegel, 1980	Reviews and new updated database were completed. Little non-task communication took place among the doctors.	Success of the group directly correlated with time online of the leader/facilitator. Deemed successful; modifications can be effectuated in an efficient and timely manner through CMC.	The technology was perceived by participants as assuming roles, some of which were roles they themselves expected to fill.
IBM Studies			
Grobowski, McGoff, Vogel, Martz, & Nunamaker, 1990 McGoff, Hunt, Vogel, & Nunamaker, 1990 Martz, Vogel, & Nunamaker, 1992 Nunamaker, Vogel, Heminger, Grobowski, & McGoff, 1989 Vogel, Nunamaker, Martz, Groboski, & McGoff, 1990	Lessons learned: Anonymity is beneficial GSS processes can aid varied group compositions Higher levels of participation Fewer meetings over less time Participants say focused Pre-meeting planning is important Post-meeting distribution of session logs is crucial Meeting room environment should match the characteristics of the group Software systems must be flexible An infrastructure of staff and support is crucial The GSS should provide for an organizational memory Results Dependent measures (descriptive or relationship results) Strongly agree: Computer better than manual Idea generation Issue identification Goal achievement Process is fair Effectiveness: GSS > manual methods Participation: equalized Efficiency: GSS < Manual in terms of man hours Satisfaction: Utilization rate of the system: high Process satisfaction: high Problem solving process Quality - positive Willingness to participate in future sessions - positive GSS- less non-task interaction Process satisfaction- positive	The results suggest that the electronic environment is a more appropriate channel for group communication than the manual one. 55.5% man hour savings were reported 92% average calendar reduction More formal, more recently established, and less cohesive groups tended to achieve higher levels of man hour savings than did similar groups without GSS technology. There are interactions between training, facilitator and participant.	