EFFECTS OF GROUP DECISION SUPPORT SYSTEMS

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ABSTRACT

Group decision support systems (GDSS) focus on the various processes of decision-making that occur as some form of a business meeting that involves multiple participants. This research reviews the literature for recent advances in GDSS applications in order to identify potential benefits and limitations of GDSS. The analysis specifically considers the elements of effectiveness, efficiency, and quality of decision-making. The research supports the consideration of a GDSS as a valuable tool for decision-making when applied in the appropriate structural context.

Keywords: Group decision support, GDSS analysis, GDSS effectiveness, GDSS experiments, face-to-face

INTRODUCTION

Meetings are an indispensable part of organizational decision makers' daily work; however, many people are reluctant to attend meetings. Meetings are important because both intense global competition and increasing customer demands require high-quality products and services, with quality management as a primary concern in many organizations (Jackson et al., 1995). Meetings are viewed as a necessary evil by many individuals because of there inherent dysfunctional characteristics that often inhibit the full participation of those individuals involved in these group processes (Burdett, 2000):

- Usually 20 percent of the participants dominate 80 percent of the time.
- People are often afraid to say what they think, or they feel pressured to conform to the group.
- Good ideas can be stifled and lost while people wait their turn to speak.
- Ideas are often judged by who said them rather than by the value of what was said.
- Individuals feel dissatisfied with the process, which causes them to be less likely to support the outcomes.

Group Decision Support Systems (GDSS) came into being to answer the requirements of decision makers and decision-making itself. According to McGrath and Hollingshead (1994), GDSS have been employed for brainstorming, i.e., idea generation; negotiation; solving "intellective tasks" that have an objectively definable "correct" answer; and addressing judgmental tasks, i.e., problems that involve resolving conflicting positions to arrive at a preferred alternative. Thorton and Lockhart (1994) pointed out another aspect of GDSS usage: Top-level executives have utilized group support systems for strategic planning and

policymaking. Overall, GDSS is being deployed in almost every aspect of decision-making. This research reviews the GDSS literature and synthesizes success example cases, experimental findings, and other reported factors in assessing the effects of using GDSS.

SUCCESS EXAMPLES

The GDSS literature contains many success example cases. These include IBM (Aiken et al., 1995; Jackson et al., 1995; Bidgoli, 1996), Price Waterhouse (Bidgoli, 1996), Boeing (Aiken et al., 1995), Texaco Incorporated (Bidgoli, 1996), and First Chemical Corporation (Jackson et al., 1995). These examples illustrate the benefits of GDSS in one way or another, and help promote the popularity of GDSS. One of the few failures is the account of the Department of Indian Health Services (HIS), Tucson (Bidgoli, 1996). However, that failure resulted primarily from a lack of support by top management – "the most frequent cause of systems implementation failures" (Bamber et al., 1995, 37).

An often-cited example of success (Aiken et al., 1995; Jackson et al., 1995) is IBM's deployment of GDSS:

> A plant manager was having trouble identifying problems hindering shop-floor control. His subordinates seemed unable to isolate causes of the problem. A two-hour meeting of six key plant personnel had resulted in a number of arguments but no solutions to the problem. The manager decided to use TeamFocus to find the problems and develop a plan of action to improve the shop-floor control process. Ten employees were invited to join the manager and two junior analysts to investigate the problem. The participants used the Electronic Brainstorming program for 35 minutes and generated 645 lines of comments about improving shop-floor control. For the first time, the manager was able to get concrete, meaningful answers to questions associated with shop floor control problem. Next, they used Issue Analyzer for 30 minutes to identify major issues related to shop-floor control. In the following 45 minutes, the 645 lines of comments were organized into the identified key categories. Then each group member used the Vote program to rank the requirements based on importance to improved shop-floor control. The accumulated results were displayed to the group, and, after 10 minutes of discussion, the meeting was concluded. In a little more than two hours the manager had a printout of all of the group's comments and a consolidated list of requirements that were prioritized by the group's vote.

This successful IBM experience yields the following observations:

1. GDSS is more effective than face-to-face (FTF) discussion. FTF resulted in no solutions while GDSS did.

2. GDSS is more timesaving. In a little more than 2 hours, the manager had hundreds of suggestions and comments that were rated and ordered while FTF used the same amount of time but generated nothing specific and useful.

3. The quality of decisions generated through GDSS is better than that generated from FTF discussion.

The three observations represent positive outcomes. However, are they specific to this particular case, or can the same results be obtained in other GDSS situations?

EXPERIMENTS AND DISCOVERIES

The extensive GDSS literature reports on various aspects of research into and experiments on GDSS. The observations from the IBM deployment are very much in alignment with some authors' portrayal of GDSS: better quality of decision (Benbasat and Lim, 1993;Townsend et al., 1995; Chudoba, 1999), improved satisfaction (Benbasat and Lim, 1993; Townsend et al., 1995; Bamber et al., 1996), time efficiency (Fjermestad and Hiltz, 1998/1999), less conflict (Townsend et al., 1995; Bamber et al., 1996), and enhanced effectiveness (Fjermestad and Hiltz, 1998/1999). While most research confirms the benefits observed at IBM, there are some divergent views. For example, Chudoba (1999) believes that, in general, GDSS use enhances decision quality, increases the number of ideas generated, but has little effect on participant satisfaction.

Townsend et al. (1995) found through their research that GDSS really improves quality. According to them, GDSS software can minimize some unfavorable features of group processes, "… such as decisions that are biased by the presence of influential members, lack of anonymity, miscommunication, interpersonal conflict, and group think. These systems foster positive group dynamics, while reducing or eliminating negative dynamics. The quality of decisions and information generated using GDSS is also enhanced. Groups using GDSS generate more ideas, reach higher-quality decisions, work through conflict, and exhibit far less inhibition than other groups." They also found, "… that participants in GDSS sessions are more satisfied with the group's decisions, ideas and the entire group process, and they make a higher individual commitment to the decisions reached by the group." The discoveries of Townsend and his colleagues (1995) match most of the inferences that we can draw from the successful IBM application. However, they did not provide any statistical support of their findings. This may, to some degree, weaken the credibility of their arguments.

Fjermestad and Hiltz (1998/1999) did a better job in this aspect. Based on a synthesis of 200 research experiments conduct by various researchers over the last 30 years, they report a 16.6 overall percent positive effect on decision making due to GDSS use compared to FTF methods. Their overall results report the use of GDSS exhibits a positive impact on effectiveness (21.0 percent). Again, this confirms the impact of effectiveness on decision-making. On the other hand, they report negative impacts associated with efficiency (17.2 percent), which is primarily attributed to the decision time. GDSS groups take longer to complete their tasks than do FTF groups. This negative impact on decision time is counter to the inference drawn from the IBM example. However, some field studies (Burke et al., 1995; Cass et al., 1991) tend to show that the use of GDSS actually reduces meeting time; thus efficiency is improved.

Fjermestad and Hiltz's (1998/1999) research contributes two other important conclusions worthy of note: (1) Task type moderates GDSS use and (2) Large rather than small groups, complex rather than simple tasks benefit more from GDSS. The first point is similar to Lam's (1997) task structure theory that is discussed below in the Other Factors sections. The second point echoes the discoveries of Aiken and his colleagues (1995), who found that it is generally more efficient to use a GDSS only for larger groups (8 and more participants) and that fairly structured tasks or tasks that are of a routine nature may not benefit from the use of a GDSS.

On the whole, two out of the three conclusions from the success at IBM, that is No. 1: effectiveness of GDSS and No. 3: the improvement of quality of decision, have strong, though not 100%, support from other researchers. When the second conclusion of time efficiency is considered, the broader results do not support this observation.

According to Bordia (1997), GDSS groups take longer to reach decisions, based on certain limitations such as the fact that it takes longer to type messages than to communicate them verbally. Cappel and Windsor (2000) reported that prior studies had found more positive results for FTF groups. In a review of GDSS studies, Hollingshead and McGrath (1995) reported that in 13 of 14 studies computer-supported groups took a longer time to make a decision than FTF groups, while in only one study there was no difference. Cappel and Windsor's (2000) experiments show that GDSS groups took significantly longer (13.37 minutes) to reach their decisions compared to 10.54 minutes for FTF groups, and FTF groups were significantly more effective in reaching consensus than GDSS groups. FTF groups were able to achieve consensus more than half of the time while GDSS had a 25% success rate for consensus.

It is always natural to observe different viewpoints for similar research factors. However, in contrast to the acclaim for GDSS benefits, other results provide different views for factors such as decision quality improvement and effectiveness,. Almost two thirds of GDSS subjects in Cappel and Windsor's (2000) experiment indicated a preference for using face-to-face communication. Results from Fjermestad and Hiltz's (1998/1999) research show that there is an overwhelming tendency to find 'no significant differences' between unsupported face-to-face modes and the types of group support systems they have studied.

OTHER FACTORS

As the prior discussion indicates, experimental studies of different GDSS applications have resulted in conflicting findings – sometimes enhancing group performance, at other times having no effect, and occasionally even resulting in worse performance for GDSS-supported groups than for traditional groups. Some researchers have fully realized that generalizations about the effects of GDSS on group decision-making have been beset by these inconsistencies among study findings, and recommended further research. Among those who have conducted further serious research are Lam (1997) and, Zigurs and her colleagues (1999).

Using meta-analysis procedures, Benbasat and Lim (1984) integrated the results of thirty-one experimental studies on the effects of GDSS use. Their results showed that group, context, and technology variables moderated GDSS effects. Lam (1997) looked at the effects of group decision support systems and task structures on group communication and decision quality and had findings that support Benbasat and Lim's discoveries.

In his research, Lam (1997) used Steiner's (1972) three types of task structures typically imposed on decision groups: additive, disjunctive, and conjunctive.

> In an additive task, each group member contributes a part to the group decision, and group performance is determined by the aggregation of individual effort. Each group member has similar responsibilities and information. In a disjunctive task, a group selects one optimal solution from an array of solutions proposed by

> individual group members. The success of the group decision depends on whether there is a member who has the ability to solve the problem and whether group members recognize and accept the superior contribution of an individual's solution to the exclusion of all others. In a conjunctive task, the successful decision can only be attained when all group members maximize their efforts because each group member possess unique information (Lam, 1997).

Through experiments, Lam (1997) found that GDSS significantly improves group decision quality when the groups are working in a disjunctive or conjunctive task situation. GDSS results in no significant quality gain when the groups are working with an addictive task. The results indicate that the effectiveness of GDSS for improving group decision quality tends to increase as the complexity of the task structure increases. The cause of the increase in decision quality can be ascribed to the fact that GDSS tended to increase the task focus and critical decision evaluation in disjunctive and conjunctive tasks.

Another important theory beyond the generalization of GDSS benefits is the task-technology fit theory developed by Zigurs and her colleagues (1999). This theory posits a typology of tasks and GDSS technologies and prescribes a best fit between the different types. The prescribed fit profile includes the following:

1. Simple tasks should result in the best group performance when done using a GDSS configuration that emphasizes communication support.

2. Problem tasks should result in the best group performance when done using a GDSS configuration that emphasizes information processing.

3. Decision tasks should result in the best group performance when done using a GDSS configuration that emphasizes information processing and process structuring.

4. Judgment tasks should result in the best group performance when done using a GDSS configuration that emphasizes communication support and information processing.

5. Fuzzy tasks should result in the best group performance when done using a GDSS configuration that emphasizes communication support and information processing, and moderate process structuring.

According to Zigurs and her colleagues (1999), "… for a simple task, communication support is all that is needed, since ideas generated do not need to be compared or evaluated. … The best fit for a problem task is proposed to be a GDSS that emphasizes information processing because problem tasks are defined by multiple solution schemes that have to be examined and evaluated. … A fuzzy task is proposed to require a high degree of communication support and information processing, combined with moderate process structuring. These GDSS elements provide group members the capability to understand and structure the problem, while evaluating highly diverse and potentially conflicting information."

Through well-designed experiments, Zigurs and her colleagues (1999) establish that the prescribed fit profiles are generally consistent with the results of their tests. For the studies in the test samples, GDSS groups typically performed better than non-GDSS groups when the GDSS

and task was a match to the theoretical fit profile. Similarly, in cases of a mismatch of GDSS technology with task, GDSS groups performed either worse or the same as non-GDSS groups. These results were reasonably consistent for the types of tasks that could be tested in the sample used. Thus, the test provides good support for the theory and explains results that were previously considered inconsistent.

CONCLUSION

A GDSS is not a panacea for all decision making. Reported research results indicate that GDSS are not appropriate for every group in every type of meeting or decision making situation. Like many other field studies, the success at IBM shows very positive GDSS results. In the GDSS literature, there are also many examples of success. However, researchers have reported conflicting results in their experiments, from strongly positive to mildly positive, from neutral to negative. The different results appear to be related to whether the task under investigation is of the right structure for GDSS use, whether the size of the group is fit for GDSS use, and whether there exists a task-technology fit. Generalizations of GDSS effects are dangerous and should be only done on the basis of comprehensive research. Nonetheless, there are many apparent advantages for GDSS use. However, using GDSS without a clear understanding of the nature and structure of the task at hand may not bring about the expected positive effects. Therefore, it is important to match the decision-making situation with its GDSS structure to achieve a task-technology fit.

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