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Abstract

Facilitation is considered one of the most critical factors in the successful use of group decision support systems (GDSS). Human facilitation is constrained by cost, availability, and consistency. These constraints are magnified when GDSS is implemented over the World Wide Web. In this paper, we explore the limitations of reliance solely on the human facilitation and propose the intelligent electronic facilitator (IEF) for supporting human facilitators. We hypothesize that a GDSS augmented with the IEF will improve the process and outcome of GDSS use. We develop an IEF prototype, and use it to test the validity of our hypothesis.

Introduction

Facilitation is defined as "a set of functions to help the group achieve its own outcomes" [Bostrom et al. 1993 p. 147], and has emerged as one of the most important factors in the effective use of group decision support systems (GDSS). It has been identified as one of the factors that may explain the inconsistent findings in studies of GDSS's impact on group performance [Anson et al. 1995]. These studies have shown that the use of GDSS impacts group performance positively, negatively or not at all [Rao and Jarvenpaa 1991, Anson et al. 1995].

Various researchers have investigated group facilitation in relation to GDSS effectiveness [Bostrom et al. 1993, Dickson et al. 1993, Anson et al. 1995, Wheeler and Valacich 1996]. Anson et al. [1995] noted that facilitation is important in enhancing GDSS effectiveness, and that higher quality facilitation can produce better group outcomes. But high quality facilitators are few and not easily available, and third-party facilitators are often problematic in view of cost and information sensitivity [Clawson et al. 1993, Anson et al. 1995]. In addition, such facilitation may not be possible when GDSS is Web-based and asynchronous (i.e. different place, different time).

The potential usefulness of automating the facilitation process has been already discussed in the literature. Anson et al. [1995] suggest that GDSS can be designed to have "facilitator-like" guidance and responsiveness, and recommend developing such a system in future research [also, Clawson et al. 1993]. Chisholm [1994] notes that Type IV meetings (different place, different time) can be self-managed because of their long duration. Limayem et al. [1993] found that limited "automated facilitation" was as effective as human facilitation and gave better group outcomes (consensus and perceived decision quality) than chauffeured support. Aiken, Liu Sheng, and Vogel [1991] have advocated the integration of expert systems with GDSS, and proposed the use of an electronic expert session manager for helping human facilitators. Chen, Houston, Nunamaker, and Yen [1996] developed an AI-based software agent for categorizing ideas in electronic brainstorming sessions, and showed that it was as effective as human meeting facilitators and took one fifth the time to accomplish its task.

This paper explores the potential of the intelligent electronic facilitator as an effective means of providing facilitation and as a complement for a human facilitator to increase the effectiveness of using GDSS.

Theoretical Foundation

Our overall hypothesis -- that augmenting a GDSS with the intelligent electronic facilitator may improve group meeting process and outcome -- is motivated by: i) the "bounded rationality" theory [Simon 1972], ii) the adaptive structuration theory [Poole & DeSanctis 1989, DeSanctis & Poole 1994], and iii) the potential for Web-based GDSS.

Facilitation requires consistency, persistence, and uniform quality during each session, across multiple sessions, and over multiple applications. The bounded rationality comes into play when the variety of tasks to be performed and the length of the session reduce the consistency of the facilitator within a session or across sessions over time. Some routine tasks, such as helping decision makers who are unfamiliar with the system, may divert the facilitator from the more critical function of managing the process. In many cases, the variation in facilitators' skills and approaches may threaten the uniform quality of facilitation. Integrating the IEF aid with GDSS may extend the bound of rationality of human facilitators by creating more consistency, persistence, and uniform quality in GDSS, and improve its effectiveness.

Secondly, the IEF has support in the adaptive structuration theory [Poole & DeSanctis 1989, DeSanctis & Poole 1994]. Adaptive structuration theory (AST) addresses how groups use and adapt structures that direct group process such as skills, rules and technology [Poole & DeSanctis 1989]. AST argues that the process of GDSS use (or appropriation) is more important to

group outcomes than GDSS itself [DeSanctis & Poole 1994]. Poole and DeSanctis [1989] state that three factors affect the success of a structure: faithfulness, positive attitude, and consensus over the structures' use. Anson et al. [1995] found that facilitation improves group process and cohesion by providing process guidance to encourage these three factors. Wheeler and Valacich [1996] found, based on Process Restricted Adaptive Structuration Theory (PRAST), which is a particular instantiation of AST, that facilitation improves group decision quality through process guidance and process restrictiveness.

We argue that the IEF imbeds guidance and process restrictiveness into GDSS in a consistent, persistent, and uniform fashion. Therefore, increasing the level of process guidance and restrictiveness through the IEF may improve group performance. This feature corresponds to Level 3 GDSS, according to the study of DeSanctis and Gallupe [1987]. Wheeler and Valacich [1996] note that GDSS configuration also can be an appropriation mediator. Thus, a level 3 GDSS may have more faithful use than a level 1 or 2 GDSS by providing additional guidance and process restrictiveness, hence leading to higher decision quality and process.

The third motivation for the IEF is its potential for Web-based GDSS. The advent of the Internet has opened a new opportunity for reconsidering traditional GDSS. The World Wide Web (WWW) may become an excellent framework for developing GDSS due to its real-time, remote and multi-user network interactions [Manguerra 1997]. Web-based GDSS may solve the traditional restrictions such as limited portability and platform-dependence. Participants could easily access and exchange necessary information, and conveniently communicate with each other through the Web, with little limitation on group size, time or place. Cost and physical constraints make the sole reliance on human facilitators impossible in a Web-based GDSS. If the Web-based GDSS is to have any future, it has to be augmented with the IEF. Therefore, the IEF could reduce physical constraints on access and decrease the cost of using GDSS.

The Intelligent Electronic Facilitator Model

Group facilitators play various roles, and the outcome of a group decision process depends on playing all roles equally well [Clawson and Bostrom 1995]. It is obvious that the IEF could not perform all the roles that human facilitators play. Following Adam Smith's golden rule [1789], we need to consider the division of labor between man and machine, and explore the specific functions in which the IEF could be effective.

Based on the 16 roles identified by Clawson et al. [1993] for facilitators, we group the facilitation function into four categories: *technology support, information management, process management,* and *group management.*

Technology Support. This function refers to GDSS technology training and help. The technology training is differentiated according to the level of the user's experience. It introduces and explains GDSS technology and its output to the users, whenever asked, so that group members can have a clear understanding of how to use GDSS correctly and effectively.

Information Management. This feature deletes duplicated generated items, combines items that are logically related, groups items by category, integrates all items by a certain scheme, and presents them in a format that is easy to understand.

Process Management. The third role refers to proposing appropriate group procedures and meeting tools to the group. Based on the group context and needs, it sets up a basic and standard meeting agenda for the group. Once the group decides the overall agenda, it makes sure that the group follows its agenda. It also decides on the time to open or close each session based on the activities of the group meeting.

Group Management. This function encourages group participants to participate actively, to contribute more to the group outcome, and to share good relationships with others. Specific roles of this feature include maintaining equal participation, stimulating multiple perspectives, preventing digression to tangential issues, maintaining harmony and building consensus among group members.

We propose the division of functions between the IEF and human facilitators on the basis of their comparative advantages. The IEF could be effective in performing routine, predictable, and context-free tasks, while human facilitators -- with their common sense and knowledge of specific circumstances -- can deal with unexpected and context-dependent functions. Of the four categories, the IEF could perform the first two, technology support (TS) and information management (IM) because they are more routine, predictable, and context-free. The other two categories, process management (PM) and group management (GM), are more ad hoc, unexpected, and context-dependent; hence they are appropriate functions for human facilitators.

This division of labor is not necessarily exclusive. We argue that the IEF's focus should be on TS and IM functions, with some additional role in PM and GM. Human facilitators are needed to conduct mainly PM- and GM- oriented functions, and deal only with the unexpected and ad hoc problems that may arise in TS and IM functions. Figure 1 summarizes our model.

We use our conceptual model to propose that adding an intelligent electronic facilitator to human-facilitated GDSS will significantly improve GDSS's outcomes.

Proposition. *Adding the intelligent electronic facilitator to human-facilitated GDSS improves group-decision outcomes.*

We operationalize this proposition by two outcome measures: perceived group decision quality and perceived group process quality. They measure two important aspects of group decision: group decision content and process. These outcome variables have been used in various GDSS studies [e.g., Limayem et al. 1993, Anson et al. 1995, Wheeler and Valacich 1996]. By using them in our study, we continue a cumulative research tradition that facilitates comparative studies. Therefore, based on this general proposition, we raise specific hypotheses for the two outcome measures.

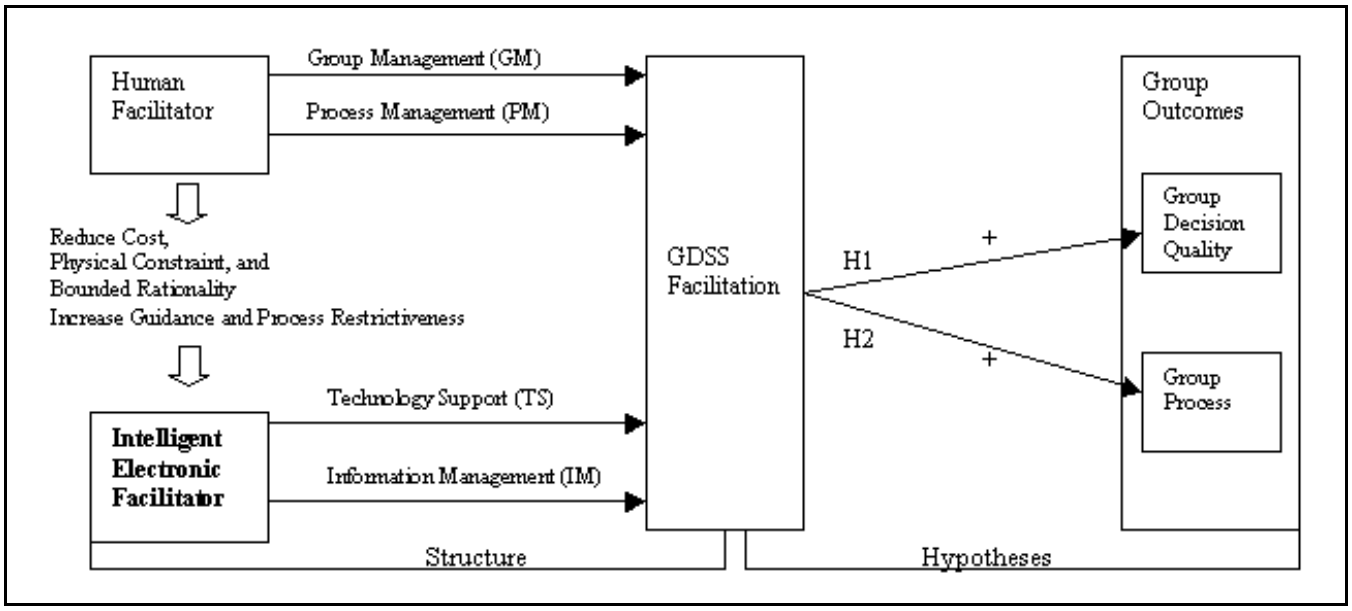

Figure 1. Structural and Conceptual Model

H1. *Human-facilitated GDSS with an intelligent electronic facilitator produces better group decision quality than human-facilitated GDSS without an intelligent electronic facilitator.*

H2. *Human- facilitated GDSS with an intelligent electronic facilitator produces better group process than human-facilitated GDSS without an intelligent electronic facilitator.*

Prototype Development and Experimental Investigation: Proposed Research

Based on the model described above, we are in the process of designing a prototype to implement the concept of an intelligent electronic facilitator. Intelligent agent technology will be used to build the prototype. The intelligent electronic facilitator will be embedded into Web-based GDSS. After the completion and test of the prototype, we will design and conduct controlled laboratory experiments to test the two hypotheses described earlier. An experiment will be designed so that groups are randomly assigned to one of the two experimental conditions: (1) intelligent electronic facilitation + human facilitation, or (2) human facilitation only.

Conclusion

The expected contribution of this study is in exploring the potential improvement in GDSS effectiveness by embedding the intelligent electronic facilitator into GDSS, and in testing empirically whether or not intelligent electronic facilitation can improve the outcome. Our study will also explore a new GDSS environment, Web-based GDSS, which is expected to emerge as a dominant mode in the future. The results of this study could provide guidance for the future development of GDSS.

References

References are available upon request from the authors (zahedi@csd.uwm.edu).