A Comparative Study of Group Decision Support Systems and Electronic Meeting Systems

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Abstract

While a great amount of research work has been done on group decision support system (GDSS) and electronic meeting system (EMS), literature review conducted by us reveals scanty information pertaining to their mutual relationships. The lack of such information often leads to confusions when one asks whether one type of system should be chosen in preference to the other. This paper reports our attempt to remedy this situation. We begin by clarifying what GDSS and EMS individually feature; differences between them will become evident as a result. Then, we proceed to delineate their mutual relationships in terms of the supporting role that GDSS plays in EMS, and vice versa. The supporting relationships between GDSS and EMS strongly suggest a better and more complete system for the increasingly demanding task of supporting meetings and/or decision making. We believe that such a system will facilitate smooth communication and interaction among the participants, with efficiency and high quality decision making as its main merits.

1. Introduction

As the size of an organization grows, it becomes necessary to partition jobs among different units. Evidently, many organization-wide decisions are made by way of meetings rather than by a single person. Moreover, participants to the meetings can be human beings including field professionals, managers, executives, etc., and intelligent systems such as databases, expert systems, etc. (Figure 1.1). As a result, a mechanism to facilitate communications and interactions among the participants becomes necessary.

Recent research on such mechanisms falls into two categories, namely, *group decision support systems* (GDSSs) (see Easton et al. (1990), Gallupe and DeSanctis (1988), Martz et al. (1992), and Steeb and Johnston (1981)) and *electronic meeting systems* (EMSs) (see Dennis et al. (1991), Dennis et al. (1988), Huber (1984), Sprague and Watson (1993), and Vogel and Nunamaker Jr. (1990)). Despite the accumulation of a large body of literature on these systems, we have not seen any in-depth investigation on the comparison and mutual relationships between the two systems in the existing literature. The lack of such information often hinders the process of evaluating whether one system should be used in preference to the other. For example, as we shall see later, an EMS may require a component whose functions are more suitably performed with a GDSS; on the other hand, current EMS technologies are clearly good candidates for supporting the communication aspects of GDSS. Such functional overlaps are responsible for much of the confusions in system selection. Moreover, integrating existing GDSS and EMS can be a major undertaking which may require system reconfiguration.

This paper reports results of our effort in providing a remedy for the situation. The present work is a comparative study of GDSS and EMS. Functional overlaps indicate that GDSS and EMS are systems with many similar features. What distinguishes them are their individual emphases on functional objectives. While GDSS emphasizes on establishing model and database so as to promote the quality and efficiency of decisions through information technology, EMS seeks to eliminate the communication obstacles among the participants through information technology so that meetings are conducted smoothly and efficiently. It is clear that GDSS and EMS will benefit from each other by mutual utilization.

We shall begin by clarifying the definitions and functional objectives of GDSS and EMS. The similarities and differences of these two systems become evident as we elaborate the supporting role that GDSS plays in EMS, and vice versa. After elucidating the mutual supporting relationships between the two systems, a system with well-defined functional objectives which is more complete than either system takes shape. Thus, alth-

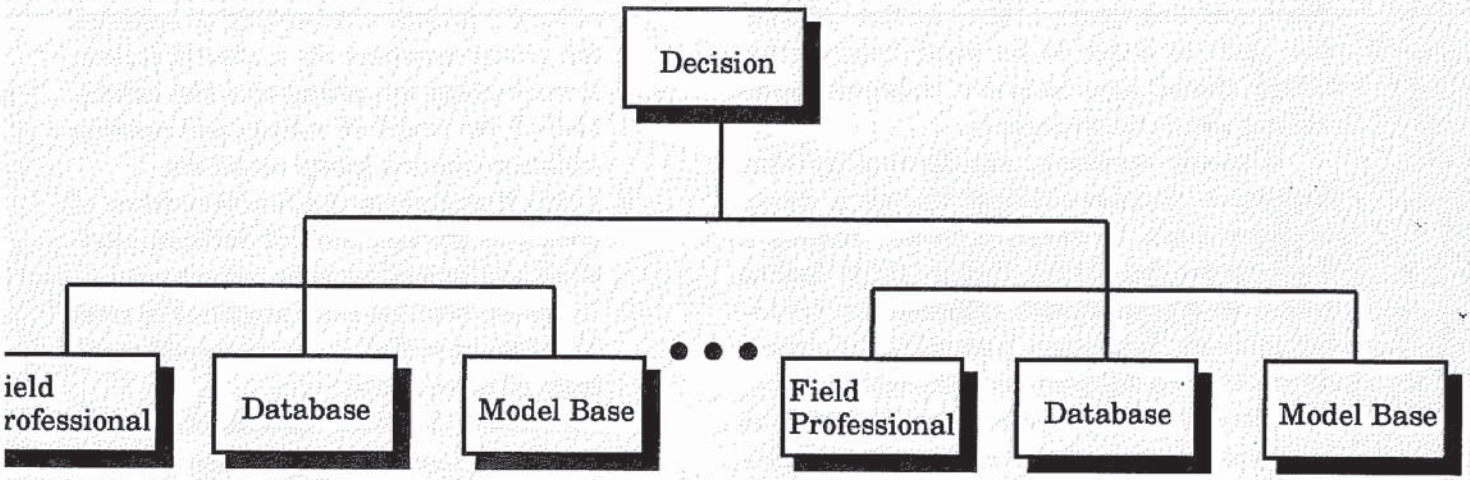

Figure 1.1: A general structure of decision-making

ough GDSS and EMS have individual goals and emphases in the current stage of development, they are two facets of a larger and more complete system that uses the existing GDSS and EMS technology as its foundation. We believe that such a system will facilitate smooth communication and interaction among the human and intelligent system participants, with efficiency and high quality decision making as its main merits.

This paper is organized as follows. Section 2 and Section 3 give overview to GDSS and EMS, respectively. Section 4 investigates the relationships between GDSS and EMS. Finally, Section 5 concludes this paper and points out future research directions.

2. Group decision support systems

Extended from the concepts of decision support system (DSS), group decision support system (GDSS) was developed in the early 1980's by Steeb and Johnston (1981), and was considerably successful by the end of that decade. The extensions introduced to GDSS make it a superset of DSS in the sense that, being capable of supporting multiple cooperating decision makers, a GDSS can certainly support a single decision maker for making decisions, see Nunamaker Jr. et al. (1991) and Steeb and Johnston (1981). On the other hand, the extensions to multi-user also has made GDSS more complex than DSS. For example, to gain acceptance, GDSS should provide a mechanism for selecting models from its model base by way of voting or ranking in the order of preference. Steeb and Johnstone (1981) further pointed out that, in order to be more trustworthy, GDSS should also facilitate communication among the decision-makers.

Broadly speaking, any technology that facilitates decision-making among a group of objects can be called a GDSS. Among a few popular definitions, Huber (1984) defines GDSS as a system with components including software, hardware, languages and procedures, etc. to support decision-making. DeSanctis and Gallupe (1985) regard GDSS as an interactive computer system that assists a group of decision-makers in solving semi-structured or unstructured problems. The National Science Foundation (NSF) working group (see Vogel and Nunamaker Jr. (1990)) considers GDSS as an application of the information technology (IT) to promote effectiveness and efficiency of group works. In summary, Huber's definition is based on its functional components, DeSanctis and Gallupe define it by task objectives, and the NSF working group's definition emphasizes what GDSS is capable of achieving.

According to Steeb and Johnston (1981), GDSS has the following characteristics:

- GDSS is a new and specialized design rather than an assembly of existing systems.
- GDSS promotes the efficiency and legitimacy of decision for a group of users.
- GDSS should be easy to learn and use.
- GDSS can be designed for solving specific problems and for general purpose usage in ordinary organizations.
- GDSS employs strategies to prevent negative group behaviors such as obstructive conflicts as well as group thinking that lacks sovereignty and individual contributions, etc.

Functionally, GDSS can be classified into three incremental levels (Figure 2.1) according to Grohowski et al. (1990) and Steeb and Johnstone (1981):

1. Level I utilizes technology to eliminate communication obstacles among members of the group who share the responsibility of making decisions. Functions of level I include the posting of opinions for group members on a shared screen, a mechanism for voting and the exhibition of the result of voting, and opinion exchange among group members.
2. Level II augments the functionalities of level I by the inclusion of decision modeling and group decision techniques.
3. Likewise, level III is an augment of level II in the sense that it also possesses some form of intelligence.

GDSSs of the three incremental levels will be able to meet the requirements of different users with different environments. Fi-

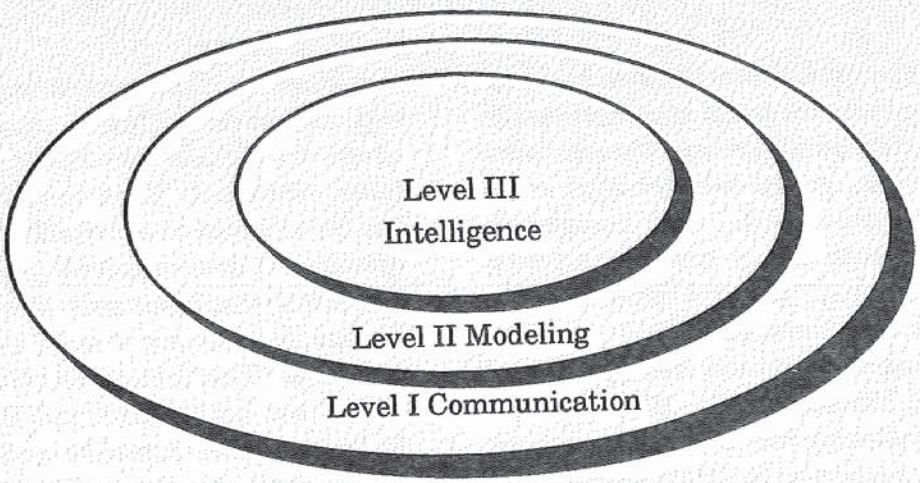

Figure 2.1: The three levels of GDSS

nally, Nunamaker Jr. et al. (1991) pointed out that the design of GDSS can also be individually tailored based on the group size, geographical locations and visual intimacy.

3. Overview of EMS

Basically, an EMS can be considered as an environment that facilitates meetings among a group of participants whose spatio-temporal relationships range from same-place and same-time to different-place and different-time. Therefore, EMSs can be classified according to the group size, temporal relationship, and spatial relationship of the participants, see Sprague and Watson (1993).

From a meeting prospective, the decision-making process invariably involves four steps: collecting individual opinions, organizing the collected opinions, voting, and reaching a final resolution. It has been reported that EMS increases the effectiveness and productivity of meetings at large, see Grohowski et al. (1990), Kraemer and King (1988), Sprague and Watson (1993), and Valacich et al. (1991). According to Nunamaker Jr. et al. (1991), EMS should:

- enable all participants to work simultaneously;
- provide an equal opportunity for participation;
- discourage behaviors that can have a negative impact on meeting productivity;
- enable larger group meetings which can effectively bring more information, knowledge, and skills to bear on the task;
- permit the group to choose from a spectrum of structured or unstructured techniques and methods to perform the task;
- offer access to external information; and
- support the development of an organizational memory from meetings to meetings.

In EMS, each individual participant is able to post his/her opinion on a bulletin board visible by other participants through their own workstations. When necessary, individuals posting opinions can choose to remain anonymous to prevent potential interference or threat. In addition, participants are allowed to compose and retrieve information simultaneously. After the proposed opinions have been collected, organized and classified, the EMS will deliver the processed opinions to the meeting for open discussion or voting. An EMS should also be able to display the final suggestion or decision, to formulate policies, and to evaluate the final suggestion.

Generally speaking, a meeting with EMS support is more effective and productive than one that without, see Gallupe and DeSanctis (1988), Grohowski et al. (1990), Kraemer and King (1988), Sprague and Watson (1993), and Valacich et al. (1991). Nevertheless, as pointed out in Sprague and Wat-

son (1993), the overall effectiveness and productivity depend on careful consideration of three characteristics: group characteristics (e.g., group size, group memberships, etc.,) task characteristics (e.g., task complexity, task requirements, etc.,) and environment characteristics (e.g., cultural aspects of the organization, deadlines, etc.)

According to Nour and Yen (1992) and Sprague and Watson (1993), EMS provides at least the following four technical supports:

- *Process support* to facilitate communication among the participants, including parallel communication, group memory, anonymity and media efficiency, etc.
- *Process structure* to regulate and support the way a meeting is conducted, e.g., forming a meeting agenda.
- *Task support* to provide information and computation associated with the task, e.g., organization memory and spreadsheets.
- *Task structure* to provide techniques, rules and modules of the relative information for task analysis to achieve new or in-depth idea.

The primary advantages of conventional meetings lie in that both information sources and new ideas are easy to achieve. However, the conventional meetings also suffer from the disadvantage of hindering a participant in his/her own thinking process. An EMS incorporated with the four above-mentioned techniques, on the other hand, is able to enhance the advantages and reduce the disadvantages of conventional meetings; see also Sprague and Watson (1993).

4. A comparison between GDSS and EMS

Summarizing the previous two sections, any interactive system that facilitates decision making in semi-structured and unstructured problem domains can be qualified as a GDSS; any information technology-based environment that facilitates a group of participants in conducting a meeting, where the spatio-temporal relationships of the group range from same-place and same-time to different-place and different-time, can be qualified as an EMS. However, being restricted by the current technological design and implementation capabilities, state-of-the-art GDSSs and EMSs have very different emphases. Even though such a result can be accepted as inevitable to a certain degree from a developmental point of view, the individual emphases very often lead to confusions and obscure a more global and integral view. This section establishes the main result that both GDSS and EMS can benefit from a more complete and unified view. As we shall see, this result is derived from the analysis of the *mutual supporting relationships* between GDSS and EMS.

4.1 Mutual supporting relationships

To begin with, a level I GDSS seeks to support decision making by eliminating group communication obstacles and by facilitating a media for the opinion posting and exchanging, in addition to decision announcements. Notice that these are supported to varying degrees by the four components of EMS; thus, it follows that EMS is sufficient to function as a level I GDSS. Furthermore, EMS possesses some qualities of a level II GDSS through the process structure component (by providing an agenda) and the task structure component (by providing decision task analysis support), which collaboratively reduce uncertainty and interference in the decision making process. Finally, since EMS includes decision support system (e.g., an expert system in the specific problem domain) as a module in its task structure component, it also possesses the intelligent quality manifested in a level III GDSS. These observations allow us to conclude that EMS provides sufficient support for GDSS.

Turning the table, GDSS seeks to promote decision quality through the support of model base and database establishments and associated tools. To fully utilize these facilities, GDSS must first provide an effective interface for group communication. This implies that the technology employed in the three incremental levels of GDSS can also be used to support the four technical components of EMS. Meanwhile, the decision support capability of GDSS can also be used as a technique in EMS for promoting meeting

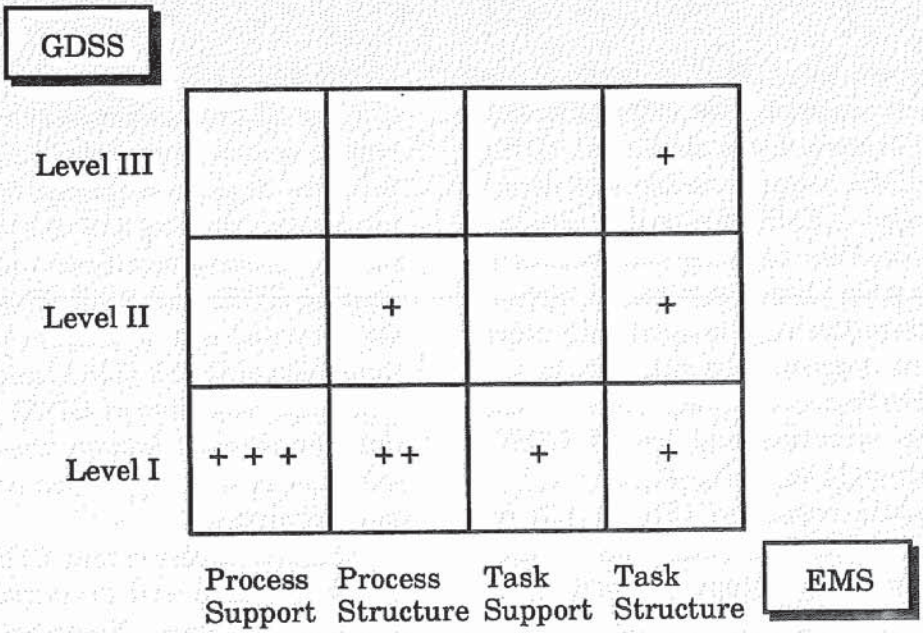

Figure 4.1: EMS supports for GDSS

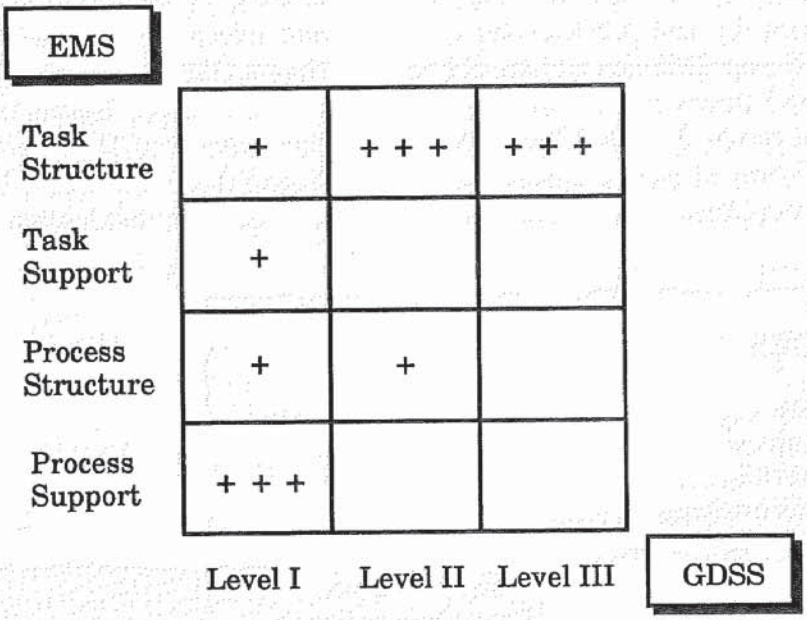

Figure 4.2: GDSS supports for EMS

efficiency. These observations allow us to conclude that GDSS provides enough support for EMS.

Figure 4.1 and Figure 4.2 summarize the above discussion by tabulating the mutual supporting relationships between GDSS and EMS, where the horizontal entities list the functions supporting the vertical entities. Pluses "+" are used in the table entries as an indication of the degree of support, with one plus, two and three pluses denoting partial support, strong support and full support, respectively. It should be noted that Figures 4.1 and 4.2 only tabulate the mutual supporting relationships between the augmented functions of each GDSS level and the EMS components. Thus, for example, in tabulating level II's functional support, functions of level I are not counted.

One way to interpret Figures 4.1 and 4.2 is to count the number of pluses by row: more pluses imply more support. For example, in Figure 4.1, EMS exhibits seven, two, and one pluses in level I, II and III GDSS

support, respectively. That is, most of the EMS supports are applicable to level I GDSS. Likewise, it is easy to see that most GDSS support to EMS happens at the task structure component of EMS. Notice that the supporting relationship between two entities is not commutative (hence two tables instead of one:) two entities may support each other with different degrees. For example, in the mutual supporting relationships between the EMS process structure and level I GDSS, the former strongly supports (Figure 4.1) but is only partially supported (Figure 4.2) by the latter. The difference simply means that EMS process structure supports level I GDSS more so than the other way around.

4.2 A synergy

The discrepancy in mutual support shown in Figures 4.1 and 4.2 logically suggests that GDSS and EMS can and should be considered as two facets of a system encompassing both of them. Figure 4.3 provides a more complete view of such a system by illustrating the similarities and differences in GDSS and EMS emphases.

Yet all the extensions in making the synergetic system more complete would be quite pointless if, given a specific task of supporting decision making and meeting, the system fails to provide significant advantages over existing GDSS and EMS. This is to say that the proposed system must enhance the functionalities of GDSS (EMS) under the current functional objective of GDSS (EMS). As we shall see in what follows, the proposed system does provide significant advantages over existing systems.

Figure 4.3 shows that GDSS emphasizes on the research and development of model base and database. Nevertheless, it is clear that in order for a group to reach a decision, meeting is required. It follows that unless the meeting of the group is conducted smoothly and effectively, the GDSS is nothing more than a DSS that happens to be used by more than one user. Recall that the communication aspects of GDSS are handled at level I. Notice that while level I GDSS provides rudimentary communication necessities for the

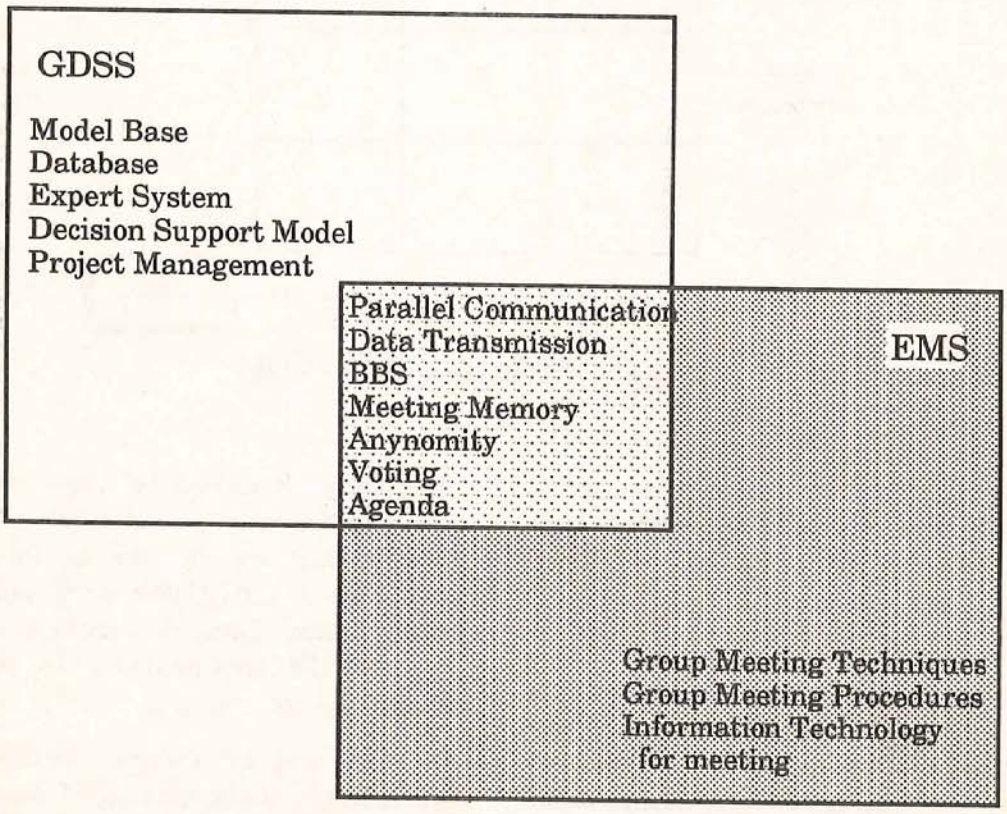

Figure 4.3: A synergy of GDSS and EMS

participants, it lacks the full versatility of an EMS in many aspects, such as the choice from a wide spectrum of meeting techniques. Consequently, GDSS users are restricted to a relatively limited repertoire of meeting techniques and may willingly or unwillingly deviate from the established meeting mode of level I GDSS. Such deviation would compromise the effectiveness of the GDSS, not only in level I but also in the incremental levels as they depend on the level I. Although the decision makers could choose to go with full power EMS to resolve this problem, such addition may be costly as it requires system integration; moreover, there will be plenty of wasteful functional overlaps. The proposed system, on the other hand, achieves the same goal without integration problems and functional overlaps.

A similar argument can be made for applying the proposed system to EMS. EMS emphasizes on the research and development of information technology to facilitate meetings with more efficient communication, more excitation, and better organization of opinions among participants. While the information technology serves to stimulate human thinking by providing an efficient interface, often neglected in the meeting context is the fact that it is also adequate to serve as a new opinion/information source for the human participants. For example, through a multi-dimensional information rendering module found in GDSS, valuable information otherwise hidden is revealed to the meeting participants. Thus, by providing the necessary GDSS functionalities, the proposed system also enhances the functionalities of EMS.

5. Concluding remarks

The present research argues how group decision support systems and electronic meeting systems can benefit from each other by mutual support in forming a group communication facility. As we explained in this paper, the participants can be field professionals, managers and executives, or intelligent systems such as databases and expert systems. Individually, GDSS and EMS are substantially different in their emphases. GDSS emphasizes on supporting decision making through its model base and database in the system; EMS emphasizes the elimination of communication barriers encountered in information technology. Although the emphases are justified from a developmental perspective, they often obscure a more global view as to what such systems should provide. The present research has delineated and clarified the relationships between GDSS and EMS in order to establish a mechanism to facilitate a group of participants in achieving its common goal. The result is a synergetic system of GDSS and EMS with advantages over existing GDSS and EMS.

There are several possible directions for future research. Here, we shall briefly discuss three of them. (1) *Management protocols.* It is evident from this comparative study that both GDSS and EMS emphasize more on their functional aspects than management aspects such as management protocols for meetings and decision-making. We believe that the development of a management protocol to support the system proposed in this paper is an important issue, see Kao et al. (1994). (2) *Object-oriented design.* Since the proposed system includes many complicated modules that can be selected according to the changing need, the system must be designed with sufficient flexibility and robustness. Object-oriented modeling techniques (see Rumbaugh et al. (1991)) seem most suitable for constructing such systems. (3) *User acceptance.* Supporting technologies for EMS and GDSS are advancing at a fast pace; we believe that one of the grand challenges that face the industry is the promotion of user acceptance.

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