A GROUP SUPPORT SYSTEM TO IMPROVE VALUE MANAGEMENT WORKSHOPS IN HONG KONG

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SUMMARY

A Group Support System (GSS) is a set of techniques, software and technology designed to focus and enhance the communication, deliberations and decision making of groups. The thousands of GSS experimental studies and field studies that have been conducted in the past two decades demonstrate that GSS is successful in improving the efficiency, reliability and quality of the group decision-making process in meetings. This paper aims to explore the application of GSS to support Value Management (VM) so as to improve the implementation of VM in Hong Kong's construction industry. It begins with an introduction to VM and discusses the problems of implementing VM, including a lack of information, lack of participation and interaction and the difficulties of conducting evaluation and analysis in construction. Further, the paper introduces a conceptual 4-S GSS framework to illustrate how the discussion, information, collaboration, and decision analysis support of this framework can be applied to overcome the problems in VM studies, and what their benefits are.

INTRODUCTION

Since the early 1970s, Decision Support Systems (DSS) have been used to support complex decision-making and problem solving for individual decision makers. Over the past two decades, organizational decisions shifted from the individual to small teams within a firm or large groups of individuals from multiple firms. This involved DSS technology and extended its application to groups of decision makers in the form of workshops or meetings (Shim et al., 2002). Group Support Systems (GSS), originally called Group Decision Support Systems (GDSS), emerged in the 1980s. GSS is defined as an interactive computer-based system that facilitates the solution of unstructured problems by a set of decision makers working together as a group. It consists of hardware, software, people and procedures (DeSanctis and Gallupe, 1985; DeSanctis and Galluple, 1987). It is also known as the collaboration system, computer support cooperative work systems, and electronic meeting systems. In short, GSS is a set of techniques, software and technology designed to focus on and enhance the communication, deliberations and decision making of groups (Aiken et al., 1995; Nunamaker, 1997).

GSS is one of the real success stories of research in the MIS academic community. Thousands of experimental studies and field studies have been conducted to investigate GDSS applications in hundreds of organizations around the world in the past two decades (Nunamaker, 1997). A significant amount of research has demonstrated that GSS is successful in improving the efficiency, reliability and quality of the group decision-making process in meetings (Nunamaker et al., 1987; Nunamaker et al., 1989; Gallupe et al., 1988; Jarvenpaa et al., 1988; Dennis et al., 1990; Grohowski et al., 1990; Greenbery, 1991; Nunamaker et al., 1996; Chun and Park, 1998; Adkins, 2002). Chun and Park (1998) pointed out that although inconsistent results caused by variations in the experimental settings and methodology adopted are reported in experimental studies, the effectiveness of GSS in supporting the group decision-making process is assured. This is because the results of field studies have consistently been positive and nearly all 'real world' users are extremely satisfied with GSS applications (Adelman, 1984; Nunamaker et al., 1987; Vogel & Nunamaker, 1988; Dennis et al., 1988). For example, a field study conducted by IBM found that a 56% saving in man-hours was achieved by the use of GSS (Nunamaker et al., 1989). Today, GSS is rapidly gaining acceptance as an effective tool for increasing the productivity of meetings in industry (Aiken et al., 1995; Gray, 1987). It has been widely used by international corporations, such as IBM, Motorola, Xerox and 3M, and by government departments in various countries, such as the U.S. Navy and NASA (Flavin and Totton, 1996). In addition, GSS has been applied to support the process of meeting preparations (Borges et al., 1999; Antunes and Ho, 2001), strategic planning (Tyran et al., 1992; Dennis et al., 1997) and classroom teaching (Kwok Ma, 1999; Alavi, 1994; Tyran and Shepherd, 2001). Recently, GSS has been also

introduced to support the collaboration of multi-organizational groups in the UK's construction industry (Franco and Rosenhead, 2001).

Due to the success of GSS in facilitating the group decision-making process, this paper aims to explore the application of GSS to support Value Management (VM) so as to improve its implementation in Hong Kong's construction industry. The paper begins with an introduction to VM and discusses the problems of VM implementation in construction. The paper also introduces a conceptual 4-S GSS framework and illustrates how the discussion, information, collaboration, and decision analysis support of this framework can be applied to overcome the problems in VM studies, and what their benefits are.

Problems of implementing VM in construction

VM is a structured and analytical process which seeks to achieve value for money by providing all the necessary functions at the lowest cost consistent with required levels of quality and performance (AS/NZS 4183: 1994). Unnecessary costs that are mainly caused by factors such as a lack of information, communication and coordination are bound to exist in construction projects. VM suggests that these costs contribute to poor value and, therefore, value for money is greater if they can be identified and removed (Norton and McElligott, 1995). VM was developed at the General Electric Company in the U.S.A. in 1947 and was first introduced into the construction industry in 1963 (Dell'Isola, 1982). In the late 1980s, VM was introduced to Hong Kong, and the success of VM has been gaining it acceptance in the construction industry since the Asian financial crisis in 1997. Many organizations including government departments, public corporations, and private enterprises have applied VM to enhance their performance in mega-sized construction projects (Fong et al., 1998). For example, the Kowloon-Canton Railway Corporation saved HK$2 billion in West Rail Project through VM studies (Thoms and Lyall, 2000). Between December 1999 and January 2000, a survey was conducted to investigate the implementation of VM studies in the industry. Its findings revealed that nearly 50% of VM users interviewed were not satisfied with current VM practices (Shen and Chung, 2000). In summary, VM users in Hong Kong's construction industry have encountered three major problems in conducting VM studies. There is a strong need to improve VM practices so as to maximize the possible benefits. The key problems of VM studies are presented in Table 1.

Problem	Reason	Impact
Lack of information	• Poorly organized project information in the pre-study phase • Difficulty of retrieving project information in meetings	Increases "uncertainty" in the outputs of VM studies
Lack of participation and interaction	• Shy about speaking in public • Pressure to conform • Domination by a few individuals • Poor team spirit	Members' contributions are reduced
Difficulty in conducting evaluation and analysis	• Insufficient time to complete analysis • Insufficient information to support analysis	Members have difficulty in responding to the "what if" question in meetings

Table 1 Problems of VM Implementation in Hong Kong's Construction Industry

A CONCEPTUAL GSS FRAMEWORK FOR VM STUDIES

GSS consists of the technologies of communication, computing and decision support, and these three technologies to the development of a 4-S GSS framework for the application of GSS in VM. A detailed discussion about the framework will be illustrated in the next section.

Communication technology aims to promote human dynamics through controlling prohibitive factors in meetings. It can be used to provide *'Discussion Support'* and therefore, to overcome the problem of lack of participation and interaction in VM studies. On top of face-to face communication, this technology provides an alternative communication channel – electronic communication to facilitate the exchange of ideas, opinions and preferences between members in the creative and analytical phases. In addition, the technology can also be used to enhance the efficiency of communication between

members in VM studies. The use of electronic communication tools, such as electronic mail and file transfer protocol, simplifies and shortens the time of the information exchange process It therefore enhances communication and collaboration between members in the pre-study and post-study phases.

Computer technology, which includes data exchange, storage, management and analysis facilities, can be used to provide *'Information Support'* and overcome the problem of a lack of information in VM studies. The use of information management tools, such as database and document management tools, facilitates the retrieval, maintenance and presentation of project information throughout VM studies. This improves the availability and quality of information to support various tasks, in particular the cost analysis, in the evaluation phases. Moreover, the technology can be used to provide '*Decision Analysis Support*' and overcomes the difficulty in conducting evaluation and analysis in VM studies. The use of decision analysis tools, such as electronic cost models and multi-criteria decision models, significantly increases the productivity of decision analysis in the evaluation phase. This not only eliminates human errors, bus also facilitates the translation of ideas into options in the development phases. In addition, the technology can be combined with communications technology to provide *'Collaboration Support,'* and supports teamwork in the pre-study and post-study phases of VM studies.

Decision support technology includes decision modeling methods, structured group methods, and rules for directing group discussions. This technology can be used to introduce a new 'group structuring technique' in order to supplement the implementation of discussion support in VM studies. The four GSS supports including discussion support, information support, decision analysis support, and collaboration support are designed for different phases in VM studies. A job plan for the application of GSS to VM is shown in Figure 1.

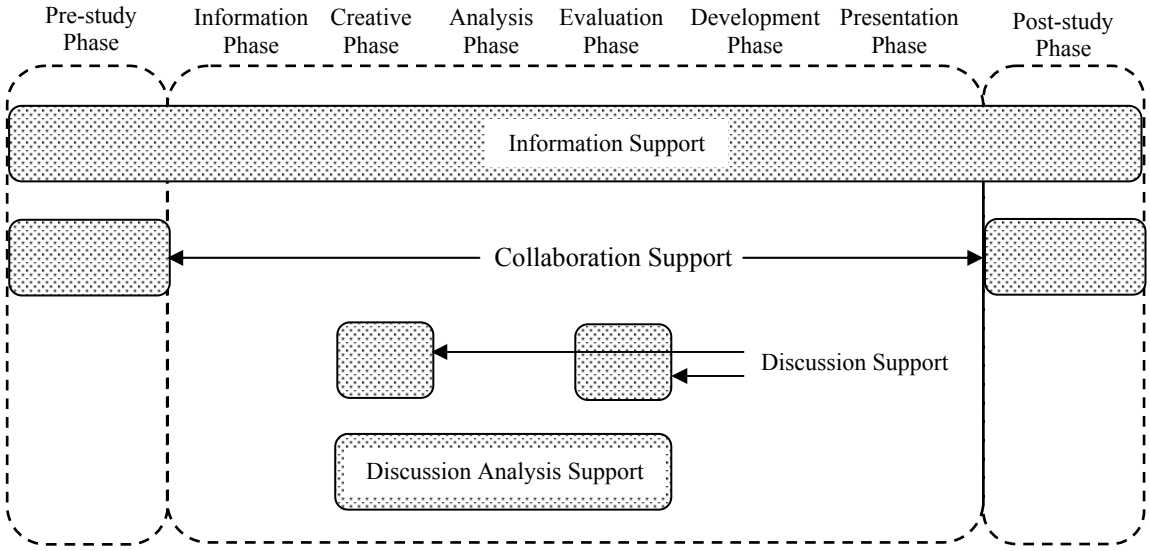

Figure 1 A Job Plan for the 4-S GSS Framework

Discussion Support

Anonymous communication is one of the key features of GSS. The discussion support mainly applies anonymity to improve the quality of discussion, and to resolve the problems of lack of participation and interaction in the creative and evaluative phases. To achieve the stated objectives, a two-stage communication method that integrates face-to-face communication with electronic communication is introduced in the creative and evaluation phases. As shown in Figure 2, this method divides the communication process into two sessions – an individual session (inner circle) and group session (outer circle). The individual session is designed to collect ideas or comments from individual members anonymously through workstations, and this information would simultaneously appear on a public screen. In the group session, facilitators adopt this information as a starting point in proceeding to the discussion in meetings. This approach aims to achieve a balanced solution in order to cement the benefits of face-to-face communication and electronic communication in VM studies. Anonymity creates a pressure-free environment and encourages members who are afraid of public speaking to speak out in meetings. It also encourages members to judge ideas solely based on their merits rather

than taking social factors in to consideration. This approach not only promotes active participation, but also introduces the individual thinking process in VM studies. As a result, members are more active and critical in discussions because they do not fear criticising the ideas of powerful players.

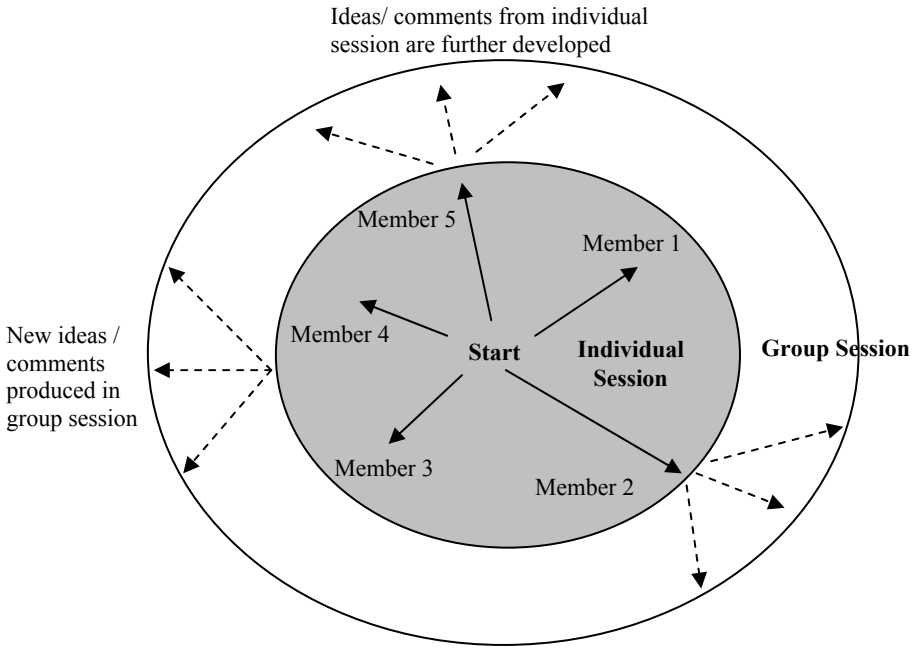

Figure 2 Two-stage Communication Method

In addition, parallel communication that allows a group of participants to communicate simultaneously is introduced to promote equal opportunity of participation in VM studies. In Figure 3, electronic communication tools such as chat rooms or online forums allow a group of participants to communicate simultaneously in the individual session. Some of them may have better keyboard skills and produce more ideas and comments in the process. However, they do not have power over other users or nor are they able to prohibit others from participating in the discussion. Therefore, the problem of domination is avoided. Using the two-stage communication method, it is expected that discussions would become more vigorous and more issue-oriented. Therefore, the quality of the discussion process is enhanced in VM studies. Moreover, the form of parallel communication also increases the total available airtime in discussion. Hence, more ideas and comments can be obtained.

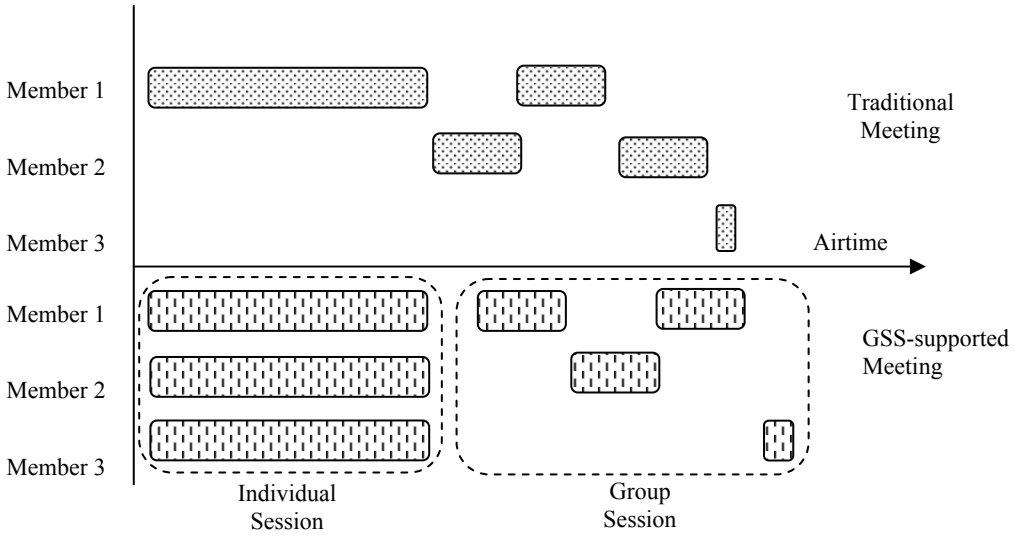

Figure 3 Parallel Communication in the Two-stage Communication Method

Information Support

The information support mainly applies electronic information tools to facilitate the information management process in VM studies. The information retrieval tools of GSS such as database and web information search engines allow members easy access in meetings to external information, including public information and corporate information, through the Internet or Intranet. They can also remotely access in advance the private information stored in their computers at their offices through these networks. These tools not only break the physical boundaries of conference rooms and improve the availability of information, but also overcome the difficulty of retrieving project information in meetings. Moreover, the information management tools of GSS including database and document management systems can be used to computerize and centralize information gathering, distribution, and circulation processes throughout VM studies. As shown in Figure 4, an electronic project information centre acts as a project hosting system to keep track of information, including both project information and data produced in meetings, and to distribute it to members during the pre-study and post-study phases. The features of point-to-group communication and electronic file transfer of this centre have simplified the procedures and time required for the process of information distribution. The centre also enhances the information circulation process by sharing project information on the Internet. This improves the consistency of information and ensures that members can always receive the most up-to-date information throughout the studies.

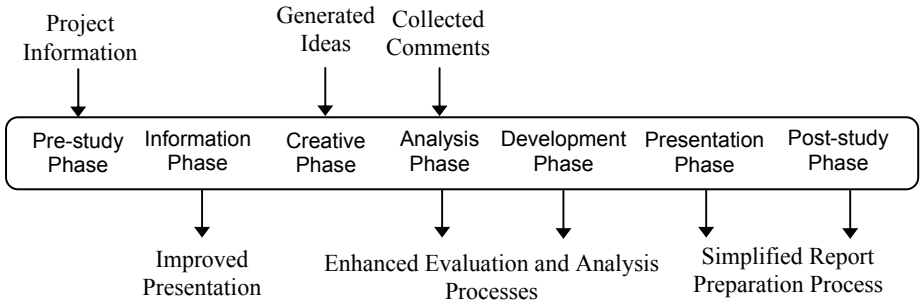

Figure 4 Electronic Project Information Centre

Through combining the communication and computer technologies of GSS, a virtual VM workshop has been developed based on the tools of the electronic information centre. The workshop aims to improve collaboration between team members through the Internet and allows members to work together as a team anytime and anyplace during the pre-study and post-study phases. The workshop consists of project briefing tools, an electronic notice board, an electronic forum, a construction library and a project information centre. The project briefing tools assist clients and facilitators in providing an introduction to meetings in the pre-meeting phase. Other than the online PowerPoint presentation, they also apply photos and short MPEG movies to create a virtual site visit so that members can have a better understanding of the project. The electronic notice board allows members to disseminate information by posting messages on a bulletin board. The messages not only displayed on the web, they will also be automatically emailed to the whole team so that all members are notified. The electronic forum allows members to enjoy group discussions in the pre-meeting phase. They can raise new topics or comment on people's topics by posting messages in a newsgroup. Similar to the notice board, the messages will also be emailed to the team members. As with the information support, the construction library and project information centre would provide a set of information tools, allowing members to store and share project information on the Internet

Decision Analysis Support

The decision analysis support mainly applies tools of electronic analysis to improve the productivity and accuracy of data processing and therefore resolves the problems of insufficient time to complete the analysis in the analysis and evaluation phases. The tools of electronic data analysis of GSS can be applied to simplify the processes of evaluation and analysis. The modelling tools of GSS, such as the life cycle cost model and the multi-criteria evaluation model, provide analytical frameworks to standardize the processes of evaluation and analysis. Members can simply input data into the models and results will be generated automatically. In addition, some commonly used software, such as

Microsoft Excel, can also be used as tools for analysis in VM studies. This software enables members to modify the data in prepared tables so as to anticipate the results of different scenarios in meetings. Members can vary the input data and the general pattern or the impact of different solutions can be produced quickly. These tools of analysis improve the productivity of evaluation and data analysis processes, and help members respond easily to “what if” types of questions in meetings

The evaluation and prioritization tools of GSS including a voting tool, an idea categorisation tool, and a weighting evaluation tool can be applied to simplify and shorten the time required for voting in the analysis and evaluation phases. Moreover, the feature of anonymity that was described in the discussion support can be introduced to avoid pressure to conform in voting. Thus, the quality of voting will improve.

Limitations of the 4-S GSS Framework

GSS can promote human interaction and facilitate decision analysis in VM studies, but it might also cause intervention in the natural group decision-making process (DeSanctis and Galluple, 1987). For example, anonymous chat rooms can promote participation and encourage interaction; on the other hand, they also reduce body language in discussion. As a result, GSS should be only used as a tool to facilitate rather than replace tasks in VM studies. In addition, GSS is only a tool for facilitators to use in organizing and operating VM studies. The effectiveness of GSS is highly dependent on how facilitators apply it in VM studies: what GSS tools apply? How to apply them and when to apply them? As a result, careful guidelines from facilitators are essential in order to ensure smooth operation in VM studies.

CONCLUSIONS

GSS is a useful information tool for improving the efficiency, reliability and quality of the group decision-making process in meetings. This paper explored a new direction in using GSS to support VM studies. It successfully integrated VM methodology with GSS technology, linking the domains of VM and GSS. Moreover, the 4-S framework was developed to illustrate how GSS technology, which includes communications technology, computer technology, and decision support technology, can be applied to VM studies. In addition, this framework also provides a set of suggested solutions including the two-stage communication method, the electronic project information centre, the virtual VM workshop, and modelling tools to overcome the problems identified in VM studies. The authors strongly believe that GSS can be successfully implemented to VM studies in practice. Further research, including experimental studies and field studies, will be carried out to investigate the effectiveness and impact of the application of GSS to VM in the near future.

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