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Organizational Factors Outweigh Technical Factors for Achieving Group Support Systems Success

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Executive Summary
Many organizations adopt Group Support Systems (GSS) to support intellectual collaborative work. Given that GSS implementation is a socio-technical intervention, both organizational and technical conditions should be met for successful GSS implementation. This study explores the effects of collaborative organizational design and technical GSS assets upon GSS success. It employed a mail survey of organizations that have installed GroupSystems. A total of 31 organizations and 152 individual users participated in the survey. Major findings of the study are:

(1) An organization's collaborative organizational design such as collaborative culture, team-based structure, role-oriented work structure, and group-based performance evaluation is significantly associated with its GSS success in terms of GSS use and users' perception of the effectiveness of GSS-supported decision making.
(2) GSS-related technical assets were not associated with GSS success.
(3) When combined, collaborative organizational design and GSS assets have significant effects upon users' perceived benefits of GSS but not upon organization's use of GSS.

The results of the study imply that investment in collaboration technology does not automatically lead to collaborative group processes. Managerial efforts to arrange organizational settings are necessary to exploit the benefits of collaboration technology.

Introduction
Many critical opportunities for improving business processes lie in seamless lateral integration within and among work groups. Thus, how to improve intellectual collaborative work may well become a major concern of today's managers. Group support systems (GSS)[1] are computer-based information systems used to support intellectual collaborative work (Jessup and Valacich 1993, p.5).

Organizations expect that GSS will bring about more efficient and effective group work by providing group members with better communication, enhanced information-processing, structured group process, and convenient access to various databases (Nunamaker et al 1991). However, it has not been empirically shown in the literature whether the enthusiastic adoption of GSS has indeed brought the anticipated benefits to organizations. Although an industry-wide survey of GSS success is not available, researchers and practitioners assert from their individual observations that it is not a rare phenomenon that organizations deploy GSS and fail to realize the original expectations (e.g., Markus and Connolly 1990; Schamel 1994).

Given that GSS implementation is a socio-technical intervention, both organizational and technical factors are needed for GSS success. With limited resources, however, a GSS project champion may wonder whether he or she should put the investment priority on the technical side or the organizational side, or split it on both. This decision dilemma has not been addressed properly in the current GSS literature. GSS studies so far have been skewed toward either the technical or

[1] Several alternative ways to name GSS exist in the literature; e.g., Computer Supported Cooperative Work (CSCW), Group Decision Support System (GDSS), Electronic Meeting System (EMS), Groupware, and Collaboration Technology (CT). Although the present study uses the term *GSS* because of its inclusiveness and wide acceptance, major focus in both theoretical analysis and empirical study is on the *electronic meeting concept* of GSS.

organizational side, leaving the interaction between the two to be exploited. Based on the organizational approach, the present study incorporates both the technical and organizational factors in a single research framework. The objectives of this study are (1) to identify the effects of technical asset factors and organizational design factors upon GSS success, respectively and (2) to examine the interaction effects of the technical and the organizational factors upon GSS success.

Research Framework

The definition and measures of information systems (IS) success vary due to the multi-dimensional nature of the construct. DeLone and McLean (1992) organized 180 IS studies to present a comprehensive model of IS success, which postulates six interrelating dimensions: system quality, information quality, use, user satisfaction, individual impact, and organizational impact (Figure 1).

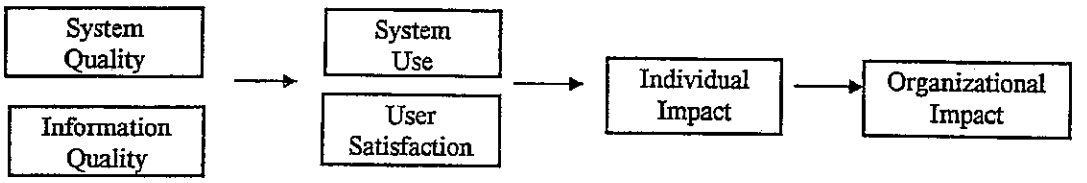

Figure 1. Information Systems Success Model (Source: DeLone and McLean 1992)

When we apply IS success model to GSS, special attention needs to be paid to the dimension of "information quality" due to uniqueness of GSS. The information quality dimension in the model refers to the information product for desired characteristics such as accuracy, relevance, and timeliness. GSS differ from other types of information systems in that quality of information can be hardly embedded in the system design. Instead, GSS often need voluntary, quality inputs of information from users to generate quality information output. Unlike transaction processing systems, for example, electronic meeting systems would not generate quality information unless the participants provide quality inputs. By the same token, users may not want to offer good inputs to GSS until they have easy access to the system, are satisfied with the system, and most importantly, experience or perceive the potential benefits from the system. Thus, we may have to assume an interacting relationship among information quality, use, user satisfaction, and individual impact when we revise DeLone and McLean's generic IS success model to fit GSS.

The four dynamic dimensions that interact with each other are also interacting with their environment. Soh and Markus (1995) categorize the environmental conditions of information technology (IT) use process into *IT assets* and *organizational conditions*. That is, in order for an information system to be used properly and generate impacts in the organization, it is necessary that the organization provide well-developed *IT assets*--e.g., hardware, software, personnel support, and user skill--and appropriate *organizational conditions*--e.g., organizational structure, processes and culture. Applying these arguments to the IS success model, the following model is attained to depict the relationship between GSS success and organizational and technical conditions (Figure 2).

The main objective of this study is to explore the effects of organizational and technical factors upon GSS success, particularly upon GSS use and individual impacts of GSS. GSS impacts in this study refers to the benefits of GSS use perceived by users. The dimensions of information quality and user satisfaction will be measured as components of the perceived GSS benefit. As such, the term GSS impacts in this study includes information quality and user satisfaction as well as individual impacts.

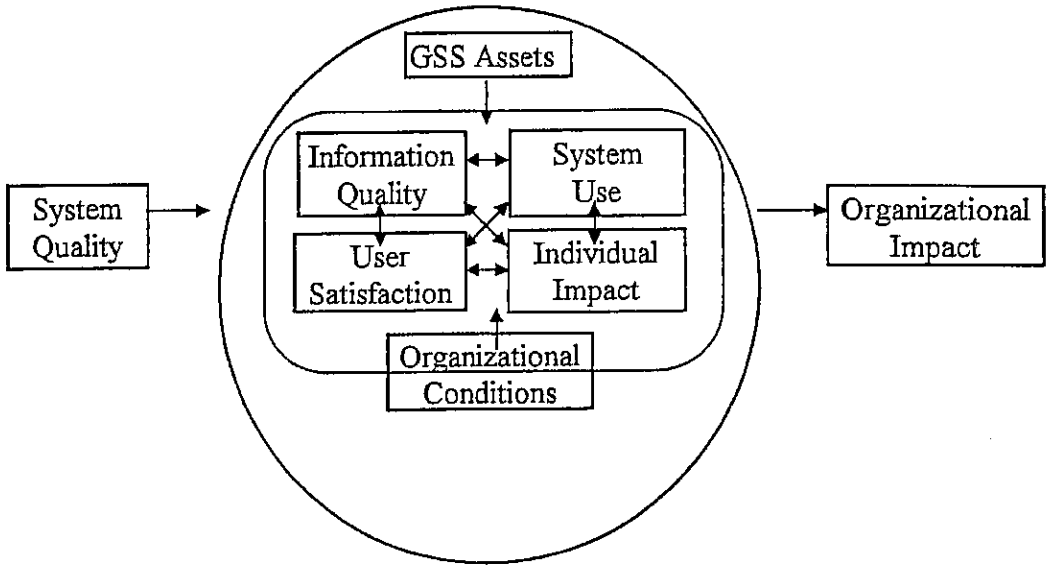

Figure 2. GSS Success and Organizational/Technical Conditions

The GSS success model in Figure 2 explains that appropriate GSS use and GSS impacts occur when at least both the technical conditions--GSS assets--and the organizational conditions for collaborative group work exist. The next question, then, is *what organizational conditions are desirable in affecting GSS use and GSS impacts?* To answer the question, this study imports organizational equilibrium theory claiming that technology-organization fit is needed for organizations to produce organizational impacts. The organizational equilibrium theory views that the organization tries constantly to achieve internal equilibrium among its subsystems as well as external equilibrium with its environment (Benjamin and Levinson 1993). According to this view, whenever innovative technology is introduced in an organization, it provokes organizational imbalance and threatens the organizational equilibrium.

Since GSS is "*collaborative* technology" and its purpose is to enhance intellectual *collaborative* work, its organizational fit can be sought in terms of organizational collaborativeness. The research framework of this study, therefore, comprises two dimensions: one is the extent to which the organization possesses GSS assets and the other is the extent to which the organizational design promotes collaboration among organizational units.

As depicted in Figure 3, this study expects that if the organization possesses rich GSS assets and is designed in such a way that collaboration among various organizational units is facilitated, then the organization is more likely to achieve impacts from GSS than an organization with either less GSS assets and/or less collaborative organizational design elements.

		Organizational Collaborativeness: High	Organizational Collaborativeness: Low
GSS Technical Assets	Rich	High GSS Use/Impacts	Low/Moderate GSS Use/Impacts
	Poor	Low/Moderate GSS Use/Impacts	Low GSS Use/Impacts

Figure 3. Interaction Effects of GSS Assets and Collaborative Organizational Design Upon GSS Use and GSS Impacts

With respect to alignment of organizational design with information technology, Majchrzak (1992) argues that organizational design efforts should focus on aligning such design elements as individuals' work structure, organizational structure, organizational culture, and performance management. Applying Majchrzak's organizational design framework to GSS technology, Lee (1996) proposes that GSS technology fits voluntary lateral processes or organizational collaborativeness that is assessed by the extent to which each of these elements promotes collaboration among organizational units.

Research Methodology

Research Hypotheses

This study proposes the following research hypotheses.

Hypothesis 1. Collaborative organizational design is positively associated with GSS use.
Hypothesis 2. GSS assets are positively associated with GSS use.
Hypothesis 3. Collaborative organizational design is positively associated with GSS impacts.
Hypothesis 4. GSS assets are positively associated with GSS impacts.
Hypothesis 5. The combination of more collaborative organizational designs with more GSS assets will have positive effects upon GSS use.
Hypothesis 6. The combination of more collaborative organizational designs with more GSS assets will have positive effects upon GSS impacts.

Operational Definitions of the Research Variables

The dependent variables of this study are GSS use and GSS impacts. Two different units of analysis are employed for the dependent variables. The unit of analysis for the variable *GSS use* is the *organization* in which GSS is deployed and can be accessed, while the unit of analysis for *GSS impacts* is *individual users* in the organization.

GSS use in this study was measured by two sub-variables: 1) the frequency of current GSS use in organizations and 2) the degree of discrepancy between expected and actual usage.

GSS impacts in this study refers to individual impacts brought by GSS use. GSS impacts were measured by efficiency and effectiveness of decision making perceived by individual GSS users. Specifically, GSS users were asked about the extent to which use of GSS has enabled their group 1) to make better decisions, 2) to set priorities more easily, 3) to make faster decisions, 4) to get more information available, and 5) to improve the quality of decisions made.

The independent variables of this study are GSS assets and collaborative organizational design. The unit of analysis for both variables is the organization in which the GSS is deployed.

GSS assets in this study refer to the organization's overall technical capability regarding GSS use. GSS assets were measured in this study by the organization's experience with GSS operation, capacity of the GSS application installed, number and technical expertise of GSS personnel, and GSS-related knowledge and skill of users.

Collaborative organizational design refers to the extent to which elements of organizational design are oriented in such a fashion that collaboration among organizational units is promoted. The collaborative organizational design construct comprises collaborative organization culture, vertical and horizontal integration among formal organizational units, role-oriented work structure, and group-based performance appraisal. The measurement of each of these elements is discussed below.

- Collaborative organization culture refers to the extent to which the organization's informal norms are such that the members work in collaboration with others, and are willing to support others and share information freely.
- Vertical integration of organizational units, or flatness of organizational structure, is measured by the number of job levels within the organization. This study used the Aston scale that identifies the number of official job levels, or vertical span, from the direct workers to the chief executive, excluding deputies to, assistants to, and secretaries.
- Lateral integration across organizational units is indicated by the existence of 1) matrix structure and 2) team structure. This was measured by 1) whether an employee has two or more supervisors and 2) the extent to which GSS users are formally organized into teams.

- The role-oriented individual work structure refers to the extent to which the duties of employees are defined by accountabilities over outcomes regardless of how the activities are carried out. On the other hand, the job-oriented work structure refers to the extent to which the duties of employees are defined by specific tasks to perform.
- Group-based performance evaluation refers to 1) the extent to which evaluation of employees' individual performance is affected by the collective outcomes of the organizational units they work for and 2) the extent to which employees' performance appraisals are affected by peer employees' evaluations.

Survey Procedures

To test the hypotheses, this study employed a survey method. The survey questionnaire consists of two parts: Part A and Part B. Part A of the questionnaire measures the organizational unit of analysis: GSS assets, GSS use, and collaborative organizational designs (see the previous section for further description). Part A was to be answered by the contact person--mostly GSS facilitators. Part B measures the individual unit of analysis: GSS impacts upon group decision making. Part B was to be answered by GSS users in the organization. Observation of an organization comprises one response for Part A and up to fifteen responses for Part B.

The survey's sample is composed of organizations that have installed Ventana Corporation's GroupSystems. This study uses GroupSystems as a representative GSS application since GroupSystems is a leading product whose primary feature is electronic meeting capability.

A list of a representative sample of organizations that have installed Ventana GroupSystems was obtained from the Seventh Annual GroupSystems Conference, March 25th through March 29th, 1996, Tucson, Arizona. Approximately 300 people from about 150 organizations participated in the conference. Approximately 100 organizations among the participating organizations are current users of GroupSystems; the others are sales institutions and research institutions that have interests in GroupSystems but do not have the system for the internal use. Although the GroupSystems user organizations come from around the world, the majority are commercial and government institutions in the United States. Sales personnel of Ventana Corporation confirmed that these organizations represent well the entire population of organizations that have purchased Ventana GroupSystems. These user organizations were represented in the conference mostly by their GSS facilitators. The list of the conference attendees provided the GSS facilitator's name, affiliated organization, voice/fax numbers, and mailing address.

The survey questionnaires were mailed to a total of 87 GSS facilitators/managers in different organizations including 75 U.S. domestic and 12 international firms. The GSS facilitators/managers completed Part A and then passed 15 copies of unanswered Part B on to in-house users of GroupSystems. After collecting the Part B answers, the contact person returned the complete set of questionnaires to the researcher. Both parts of the questionnaire were designed to be answered anonymously.

For Part A of the questionnaire, 33 organizations responded. Out of the 33 organizations, 31 cases offer valid responses (valid response rate: 31/87=35.6%). For Part B of the questionnaires, a total of 152 users from 28 organizations provided valid responses.

Research Findings

Collaborative Organizational Design and GSS Use

Hypothesis 1 of this study states that collaborative organizational design is positively associated with GSS use. The survey results support Hypothesis 1. The correlation coefficient that measures the linear relationship between collaborative organizational design and GSS use was .414 (n=31). The correlation is significant at the 0.05 level.

Further, breakdown analyses of the dependent variable (GSS use) show that collaborative organizational design is positively associated with both the GSS usage and the usage penetration (current usage compared to the expected one). Among the four sub-variables of the independent variable, only collaborative organization culture showed significant correlation with GSS use at the 0.01 level. None of the other elements of collaborative organizational design was significantly associated with GSS use. Organization structure, a sub-variable of the independent variable, is composed of its own three sub-variables that include matrix structure, team structure, and flat

structure. Among the three organization structures, only team structure showed significant correlation with the dependent variable at the 0.05 level.

GSS Assets and GSS Use

Hypothesis 2 states that GSS assets are positively associated with GSS use. Contrary to the hypothesized relationship, the correlation between GSS assets and GSS use was .232 (n=31). The correlation is not significant at the 0.05 level. Since the stated hypothesis is not accepted, a statistical power analysis was conducted to examine the extent to which the sample data suggests that the hypothesis is indeed false. Statistical power of the test was .25, which indicates that the current data does not strongly imply the falsity of the stated hypothesis. In addition, an analysis of sample size showed that approximately 110 additional observations are needed to attain a statistical power of at least .80, assuming that the same correlation is maintained when we add more cases. Thus, a study with a larger sample size is strongly suggested to further examine Hypothesis 2.

Among the seven sub-variables of the independent variable--years of GSS operation, decision room capacity, CPU speed, full-time equivalent (FTE) workers on GSS, worker experience, and overall technical resources--number of FTE workers was found to be positively associated with GSS use (rho = .388) and technical experience of GSS workers was negatively related with GSS use (rho = -.425) both at the significance level of 0.05. All the other correlations were not significant.

The negative correlation between GSS use and technical experience of GSS workers is interesting because it means that people don't use GSS very often where the GSS facilitators or managers have more years of GSS or GSS-related technical experience. One possible explanation is that GSS personnel with extensive technical experience tend to be technology-oriented and may lack good interpersonal skills.

Collaborative Organizational Design and GSS Impacts

Hypothesis 3 stated that collaborative organizational design is positively associated with GSS impacts. The survey results show that correlation (Spearman's rho) between collaborative organizational design and GSS impacts is -.161 (n=152) and is significant at the 0.05 level. The negative correlation is due to the fact that the scores of GSS impacts were reverse-coded (the highest perceived benefit = 1; the lowest perceived benefit = 5).

Breakdown analyses of the dependent variable show that collaborative organizational design is significantly associated with satisfaction with decision, quality of decision, and ease of prioritization at the 0.01, 0.05, and 0.10 level, respectively but not with decision making speed and information availability. Given that satisfaction with decision and decision quality represent the effectiveness rather than efficiency of decision making, the result implies that users in more collaborative organizations tend to perceive a greater effectiveness of GSS-supported decision making than those in less collaborative organizations.

Among the four sub-variables of collaborative organizational design, organization culture and group-based performance evaluation are associated with users' perceived benefit at the 0.05 significance level, while organization structure and work structure are not.

GSS Assets and GSS Impacts

Hypothesis 4 stated that GSS assets are positively associated with GSS impacts. But the survey results show that the correlation coefficient (Spearman's rho) between GSS assets and GSS impacts was .029 (n=152), indicating the correlation is not significant. Statistical power of the test was .05. The results of both the significance and power test imply that the current data set may not appropriate in terms of both the data distribution and the sample size for testing the linear association between organizational GSS assets and users' perceived benefits of GSS.

Breakdown analyses of the sub-variables show that 1) none of the sub-variables of GSS impacts has a significant correlation with GSS assets and 2) among the seven sub-variables of GSS assets, only the number of FTE workers were found to be significantly associated with GSS impacts at the significance level of 0.01. All the other correlations are not significant.

Collaboration Quadruples and GSS Use

Hypothesis 5 of the study states that *the combination of more collaborative organizational designs with more GSS assets will have positive effects upon GSS use*. The purpose of this hypothesis is to

examine if there exists an interaction effect between GSS assets and collaborative organizational design upon GSS use. To investigate the statistical significance of the interaction effect, this study employed a statistical technique of two-factor analysis of variance (ANOVA), which examines simultaneously the two treatments: GSS assets and collaborative design. The results of two-factor ANOVA show that there is apparently little or no interaction between GSS assets and collaborative design, indicating that the two variables do not jointly affect GSS use. This assertion is due to the fact that the F statistic for two-way interactions was 0.680 which is not significant. Thus, Hypothesis 5 is not accepted. The statistical power of the test was approximately .96, which indicates a strong confidence that the stated hypothesis is in fact false. The results are consistent with those in the previous sections. That is, the results confirm that collaborative organizational design seems to be an important factor of GSS use, while GSS assets does not.

Collaboration Quadruples and GSS Impacts

Hypothesis 6 states that *the combination of more collaborative organizational designs with more GSS assets will have positive effects upon GSS impacts*. the results of two-factor ANOVA indicate that the F statistic for two-way interactions was 7.173, which is significant at the 0.01 level. Thus, there seem to be interaction effects between GSS assets and collaborative organizational design. In other words, there are systematic effects on GSS impacts, which are attributable only to the combination of a particular class of GSS assets with a particular class of collaborative design. Thus, Hypothesis 6 is accepted.

Discussion and Conclusions

Summary of the Findings

The major finding of the study is that collaborative organization design is an important factor of GSS success (Figure 4). Among the sub-variables of collaborative organizational design, collaborative organizational culture was distinctive in its association with GSS success. This result implies that the presence of collaborative organization culture is a good indicator whether an organization will succeed in implementing GSS. The implication appears to be paradoxical when considering organizations' motivation to implement GSS. They are implementing GSS because they want to encourage collaboration among work groups. But they paradoxically need a certain degree of collaborative organizational setting to exist in order to gain the benefit of GSS. This paradox is due to the nature of collaboration technology, whose beauty lies in extending mental rather than physical/operational capability. Extension of working groups' mental capabilities should require increased cognitive efforts, learning, and adjustment in the organizational level as well as in the individual level (Slaughter and Beath 1993).

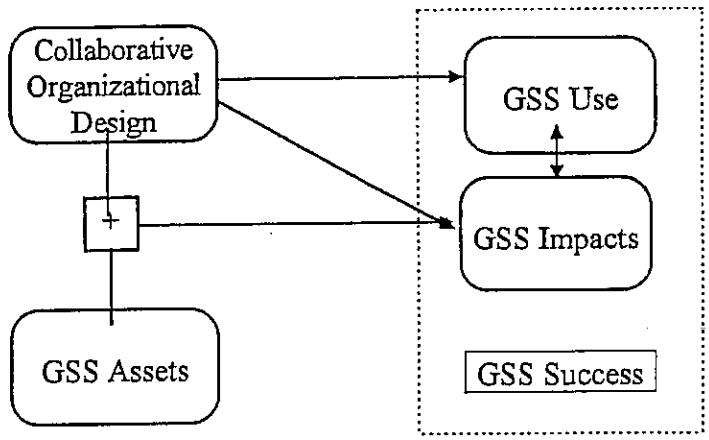

Figure 4. Effects of Collaborative Organizational Design and GSS Assets on GSS Success

Figure 4 depicts that the survey data failed to show that an organization's GSS assets such as the hardware capacity and technical skills/experience on GSS are significantly associated with GSS success. Further, the data supported only partially the combination effects of collaborative organizational design and technical assets of GSS upon GSS success. That is, the two factors jointly contribute only to increasing users' perceived benefits of GSS, but do not contribute to increasing GSS use. Although statistical power tests indicated that the inability to associate GSS assets with

GSS success may be due to lack of sufficient observations, the findings at least suggest that GSS assets are a less important factor of GSS success than collaborative organizational design.

The finding that GSS assets have limited or little effect upon GSS success is consistent with the so called *IT productivity paradox*, which refers to the phenomenon that increases in firm performances are not associated with investment in information technology. The finding supports the perspective that IT productivity paradox is caused by an approach of viewing IT as a commodity, which is something perfect by itself and brings some standard performance without much additional arrangements by users. Instead, the study's findings imply that deployment of GSS will not make much difference on an organization's group processes if the organizational settings are improper such that the target users are not encouraged to use the technology. As the descriptive analysis of the findings show, even though most people agree that use of GSS helps their decision making, they do not come to use it partly because their organizational designs mismatch the assumptions of the technology.

Although the impact of overall GSS assets were found not to be significant, investigation of relationships among the sub-variables of GSS assets and the dependent variable showed that the number of full-time workers on GSS (one of the sub-variables) was significantly associated with GSS success. This finding is notable because it implies that organizational commitment seems to contribute to GSS success; the number of full-time GSS workers is apparently an indicator of organizational commitment to GSS implementation.

Implications for GSS Implementers

The implication of the study's findings is that before making decisions to implement GSS, a manager should first assess whether the organizational climate is proper for the technology. Special attention should be paid to the organization's collaborativeness. If the GSS implementer finds that the organization does not have these attributes of organizational collaboration, he or she should expect less from the GSS technology. Since redesign of an organization is typically beyond a GSS implementer's authority, he or she should make efforts to make top management aware of both the mismatch and the need for collaborative design.

In addition, when deciding on investment in GSS, a manager should avoid exclusive reliance on technical excellence. Neither state-of-the-art hardware capacity nor decades of technical experience on the technology alone contributes much to GSS implementation success. In other words, the study shows that deployment of high-speed computers, allocation of large space for decision room facilities, placement of highly-experienced technicians, and assuming that people will eventually learn the systems do not bring about active use of GSS. The only significant technical factor is the number of people working full-time on GSS, which seems to be an indication of management's commitment to GSS. Thus, a GSS implementer should ensure that the organization is committed to the implementation and assign enough employees to support the technology use within the organization.

Limitations and Future Studies

Although the study provided some useful findings such as close correlation between collaborative organizational design and GSS use, additional research is called for due to limitations of the study. First, this study used a small sample size of 31 organizations for the organizational unit of analysis. As confirmed through statistical power tests, the results of statistical analyses did not provide confident information for such hypotheses as H2 and H3. Therefore, a replication study with a larger sample is strongly desirable for more confidence in testing the hypotheses. Second, since the study's focus was on the electronic meeting features of GSS and examined only Ventana's GroupSystems, the results may not be generalized to the GSS technology as a whole. Thus, replication research on other applications of GSS should be conducted. Another concern about the generalizability of the findings is that the present study examined GSS implementations in mostly U.S. firms. Replication studies with non-U.S. firms will be worth pursuing.

Conclusion

This study found that an organization's collaborative organizational design such as collaborative culture, laterally integrative formal structure, role-oriented work structure, and group-based performance evaluation is significantly associated with its success in implementing GSS--specifically electronic meeting systems like GroupSystems--in terms of GSS use and users' perception of the effectiveness of GSS-supported decision making. However, the study did not find the relationship between an organization's GSS-related technical assets and its GSS success. When combined, collaborative organizational design and GSS assets have significant effects upon users' perceived benefits of GSS but not upon an organization's use of GSS. Managers should not expect collaboration technology alone will do the job. Collaboration technology helps those who are willing and motivated to be collaborative!

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