Fifteen Years of GSS in the Field: A Comparison Across Time and National Boundaries

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Abstract

It has been over two decades since Group Support Systems (GSS) emerged on the Information Technology (IT) scene. GSS have now been commercialized and are present in an increasing number of domestic and international contexts but only lightly studied in real organizational settings. A criticism of studies has been that many of the organizations involved had a vested interest in the outcome that extended beyond that which would normally occur in a typical organization. An additional challenge has been made with respect to the generalizability of field study results across corporate and national cultures. This paper compares and contrasts findings from International Business Machines (IBM) and Boeing Aircraft Corporation in the US with those from two European companies: Nationale-Nederlanden (NN), the largest insurance firm in the Netherlands and European Aeronautic Defense and Space company, Military division (EADS-M). Attention is given to aspects of efficiency, effectiveness, and user satisfaction as well as group dynamics.

1. Introduction

It has been over two decades since Group Support Systems (GSS) emerged on the Information Technology (IT) scene. GSS are defined as socio-technical systems consisting of software, hardware, meeting procedures, facilitation support, and a group of meeting participants engaged in intellectual collaborative work [11, 21]. GSS are employed to focus and structure group deliberation, while reducing cognitive costs of communication and information access among teams working collaboratively towards a goal [4]. Early studies in university environments, for example [15], were followed by studies at organizational sites, for example [18]. GSS have now been commercialized and are present in an increasing number of domestic and international contexts [26].

There is one main question with respect to studies that looked at real organizational groups using GSS: there are comparatively few organizational groups that used GSS in their own environment, i.e. the organization of which they are part. Most studies on real groups report on visits that the group made to facilities outside the organization, most often on the premise of the researchers involved. Exceptions include, e.g., the use of SAMM by the IRS in New York City [10] and GroupSystems at the US Navy ThirdFleet [3].

An additional challenge has been made with respect to the generalizability of field studies results across corporate and national borders. Comparatively few studies have occurred in international contexts, see [26] or [38] for an overview. Those that have occurred have involved use of university facilities, for example [25]. It would be interesting to investigate the day-to-day use of GSS in organizations headquartered outside the US It is a matter of not only academic curiosity but also of practical relevance to multi-national and international corporations to find out how (or if) results generated in US organizations compare to those generated in international contexts. This knowledge can support investment decisions concerning the implementation of GSS facilities. It can also inform decisions whether or not to put GSS forward as a company wide 'best practice' to be used locally or across borders by multi-national teams.

In this paper we compare and contrast finding from International Business Machines (IBM) and Boeing Aircraft Corporation in the US with those from Two European company's: Nationale-Nederlanden (NN), the largest insurance firm in the Netherlands, and European Aeronautic Defense and Space company; Military division, the producer of the Eurofighter. First, we discuss organizational studies on GSS in more detail. Second, we elaborate on our research approach. Third, we discuss the results of our comparative study in which attention is given to aspects of efficiency, effectiveness, and user satisfaction as well as group dynamics. Special emphasis is given to comparison across contexts in

field settings and illustrations of return on investment as organizations seek to develop support (if warranted) for embracing GSS on the way to broader distributed use. Finally, we discuss the results and conclude the paper with a summary of the most important findings and implications for further research.

2. Background

GSS have been studied in a number of fashions, e.g., laboratory experiments, field studies, field experiments, and surveys [13, 14, 34]. There have especially been a relatively large number of laboratory studies [30, 39]. These studies have most often used student groups without a past or a future. Results have been mixed. Although some studies have reflected positively on the use of GSS, others have not. Over time some attempts have been made to compare results across these lab studies. For example, Gray et al. [17] noted consistency within groups with similar characteristics but other characteristics and study focus were too varied to draw conclusions. Dennis et al. [7] found that GSS use improves decision quality and quantity of results. Large groups using GSS appear to benefit more than smaller groups. A comprehensive overview of laboratory studies is given in [13].

Studies of GSS in the field have occurred in two fashions. In the first, researchers have invited organizations to use university facilities, see for example [1,8,33]. It is important (and convenient) to do such studies in university contexts where variables can be more systematically explored and sufficient sample sizes be developed under more controlled circumstances. In the second, researchers have studied organizational groups in situ. Only a few examples of such studies exist. For example, Poole et al. [31] used SAMM developed at the University of Minnesota at Texaco as well as other organizations. Jarvenpaa et al. [20] used a specially developed prototype at MCC. Five studies used GroupSystems, developed at the University of Arizona:

1. *International Business Machines*. GroupSystems was introduced at IBM in 1987. A series of studies at this site followed that demonstrated that GSS technology could be effectively introduced in organizational environments [18, 35]. Based on success at the first facility, IBM installed the technology at six more sites over the following year and similarly expanded their internal facilitation support capabilities [18, 35, 24]. IBM continued expanding internally to 24 sites and beyond with the same format of use e.g., pre-planned session agendas with facilitation support throughout the meeting process. The facilitation role has been institutionalized with several generations of facilitators emerging from a wide variety of backgrounds and levels of experience with group and organizational dynamics.
2. *Boeing Aircraft Corporation*. A study was also carried out at Boeing Aircraft Corporation that, encouraged by reports of IBM's success, decided in 1990 to conduct a carefully controlled pilot test of GroupSystems in their organization. Boeing collected data so that a business case could be developed either in favor of, or against the wide-spread use of GSS to support their projects. After 64 sessions, costs were evaluated. The flowtime, or number of calendar days required to produce the deliverables, was reduced by an average of 91%. The man-hour cost savings averaged 71%, or an average of $7,242 per session, for a total savings of $463,488 over the 64 sessions [32]. This was despite the fact that expense figures included the initial start-up of installing the meeting room technology, training facilitators, and collecting the measurement data.
3. *World Bank*. Another study was carried out more recently at the World Bank headquarters in Washington. In this study, a historical account was given of the acquisition, installation, and early experiences with GroupSystems [2]. The results indicate that after a very successful pilot period in which 102 sessions were organized, the members of the organization accepted the technology as a means of conducting more participative and more effective meetings. As a result of the successful initial adoption of the technology at the organization's headquarters, it has been decided to take the technology to the field as well, see e.g. [22].
4. *Nationale-Nederlanden*. A study that, in part, is the focus of this paper was carried out at Nationale-Nederlanden (NN). Part of the ING Group, NN is the largest insurance firm in the Netherlands and one of the market leaders in Europe. NN was introduced to GSS at Delft University of Technology in 1995. Based on early success, NN continued to use GSS and develop its own internal facilitation capabilities [36]. Following the successful use at NN, other parts of the ING Group have also started to use the technology.
5. *U.S. Navy Commander, Third Fleet*. During a longitudinal field study on board the U.S.S. CORONADO, researchers investigated the acceptance, use, and diffusion of GSS by U.S. Navy staff [3]. In the course of the study, the researchers supported various groups in a number of exercises. The study focused on understanding why certain groups of users became self-sustaining over time while others did not. Based on their insights, the researchers state a number of guidelines for establishing an effective GSS facility.
6. *European Aeronautic Defense and Space Company, Military division.* EADS-M is a cooperation of four European companies' in producing the Eurofighter and other military aircrafts. EADS-M was first introduced to GSS by Delft University of Technology in 2001. Based on a successful study on added value of the GSS for the

Table 1. Overview of some GSS field studies and their findings.

Source	Context	Findings
Nunamaker et al. 1987 [28]	100 planners in 7 groups from 3 organizations	Decreased idea generation inhibition, anonymity separated status, authority and roles from comments, equal participation opportunity, high participant satisfaction.
Nunamaker et al. 1989 [29]	Various IBM meetings	Higher perceived and measured meeting effectiveness and efficiency, improved meeting outcome quality, high participant satisfaction.
George et al. 1992 [16]	Tucson office of the Indian Health Service	Despite successful GSS introduction, GSS adoption failed: the facility was dismantled after 9 months due to lack of use.
Post 1993 [32]	Various Boeing meetings	Higher perceived and measured meeting effectiveness and efficiency, higher quality of meeting results, high participant satisfaction.
Tyran et al. 1992 [33]	8 strategic management cases in 5 organizations	Higher participation, higher perceived meeting efficiency, more equality of participation, little evaluation apprehension and cross-hierarchical communication support.
Dennis 1994 [5]	10 meetings involving 5 organizations	Higher perceived meeting effectiveness and efficiency, high participant satisfaction.
Emery 1994 [12]	GSS for IS requirement determination	Perceived efficiency improvement without sacrificing effectiveness.
Krcmar et al. 1994 [23]	50 meetings with various organizations	Parallelism perceived to be most useful, divergent perception of usefulness anonymity, perceived correlation between meeting success and task clarity, equal participation, and meeting room comfort.
Bikson 1996 [2]	102 meetings in the World Bank	High participant satisfaction with methods and technology, perception of increased effectiveness and participation.
Herik and Vreede 1997 [19]	2 cases at Ministry of Spatial Planning, Housing and the Environment	High satisfaction with the technology itself, but a neutral evaluation of outcome quality and effectiveness. Positive perception on efficiency and anonymity, but GSS offered too little support for debating and negotiations.
Vreede and Wijk 1997 [37]	9 Nationale-Nederlanden Insurance meetings	Higher perceived and measured meeting effectiveness and efficiency, higher perceived quality of results, high participant satisfaction.

company, a GroupSystems license was acquired and internal facilitators were trained.

In field studies, researchers have typically assessed the use of GSS to solve real organizational problems. The results from field studies have tended to be more cohesive than those from laboratory experiments [14]. In Dennis et al. [9], a specific comparison of laboratory and field studies noted that differences were not so much a matter of incompatible results as a function of characteristics of the groups, task, and technology. Those laboratory experiments that tended to exhibit characteristics of organization groups tended to generate similar results. Furthermore, the results from GSS field studies predominantly paint a *positive* picture. Some can even be considered as 'success stories', see the illustrative overview presented in table 1, in which a number of field studies and their findings are summarized. This overview suggests that teams using GSS to support creative problem solving may have more effective and efficient meetings than teams that use manual processes.

3. Research Approach

In this study, we have set out to compare GSS results from four international organizations that were collected over a time span of 15 years. Results are compared in different contexts and cultures. It explores the differences that might occur as a function of organizational context while being relatively consistent in group- and task characteristics as well as the type of GSS applied.

3.1 Setting

In this comparative case study, we use four organizational settings i.e., International Business Machines (IBM), Boeing Aircraft Corporation, Nationale-Nederlanden (NN) and European Aeronautic Defense and Space Company; Military division (EADS-M)

IBM is well known worldwide as a manufacturer of computer hardware and software plus a service provider for those products. The data reported in this study was gathered at an IBM manufacturing plant with approximately 6000 employees located in a rural setting in upstate New York. A room to house the GSS was remodeled according to the design of an operational facility at the University of Arizona. In the room, a U-shaped table was equipped with ten networked microcomputers. An additional microcomputer attached to a large screen projection system was also on the network to enable display of work done at individual workstations or of aggregated information from the total group.

Boeing Aircraft Corporation is mainly known as a designer and manufacturer of airplanes of all sizes, but especially the large ones. With more than 160,000 employees globally, the company has a rich diverse infrastructure, making the mapping of teamwork composition very difficult. This magnitude and vitality makes this organization very suitable for GSS. Encouraged by the success of the research at IBM Boeing initiated a highly controlled test of GroupSystems in their organization in 1990.

NN, is the largest insurance firm in the Netherlands and one of the market leaders in Europe. The firm's products include life, accident, and health insurance as well as financial services. The firm operates in a turbulent market. There are many competitors and their number is increasing, while the market itself is saturated. NN was introduced to GSS at Delft University of Technology in 1995. Positive initial experiences triggered the management to request the researchers from Delft to assess the added value of GSS for their company. For this purpose, over 40 GSS meetings were organized and evaluated. The first two sessions were held at University facilities followed by mobile use at a variety of corporate locations in the Netherlands.

EADS-M is a European cooperation of several European company's with as main project, the development of the Eurofighter aircraft. The study was done at EADS-Military situated at Ottobrunn (Germany). The GSS was situated in a computer classroom for computer education, not very suitable for GSS meetings causing problems in verbal communication. Based on initial experiences with GroupSystems during an internal project, facilitated by Delft, University of Technology, a request for further research on the added value of the GSS for EADS-M was a result. After the pilot project the system was acquired (winter 2001) and facilitation training has taken place (spring 2002).

3.2 Research model

The research model for our study illustrated in figure 1 is drawn from prior research [6] and expanded upon in [27]. This model was used to guide the collection and analysis of data on GSS use in both organizational contexts. This model is useful for the following reasons. First, it is a *descriptive* model and our study is a *descriptive* study. Second, it has been proven useful in many other studies, see e.g. [19, 24, 29]. Finally, the model enables a way to classify and organize many critical incidents reported in a case study on GSS use.

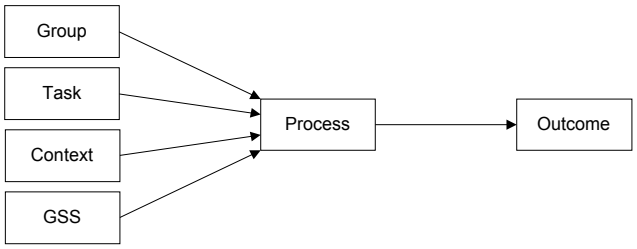

Figure 1. The research model used in the study.

The model addresses issues related to individual, group, project, and organizational levels of analysis that we feel are particularly relevant to GSS design and implementation. The characteristics of the group, task, context, and technology are represented as influencing process which, in turn, influences outcomes.

- Group characteristics data collected include size and the composite of experience, cohesiveness, motivation, and history that constitutes group member attitudes and involvement.
- Task characteristics data include task type, complexity, and task application area.
- Context characteristics data include the organizational environments such as area of business, nationality, and organizational culture.
- Technology characteristics data include GSS hardware, software, and setting configuration.
- Process characteristics data include aspects of the procedures, anonymity, level of participation, facilitation, and interaction of group members during the GSS meetings.
- Group outcomes data include issues such as satisfaction, quality of outcomes, time required to reach resolution, consensus, and decision confidence.

Our method of analysis is based upon multiple sources of data. Questionnaires and post session interviews as well as expert estimation, observation, and system logs all played a role. Specifically, we revisit IBM and Boeing data and compare it to data collected from NN and EADS-M under comparable group, task, and technology characteristics.

3.3 Comparison and contrast

In sections 3.1 we discussed the organizational context of all four organizations. This section will provide some general

information about the task, technology and context at the different organizations in terms of our model in figure 1. We note a number of comparisons and contrasts that establish the foundation of this study:

- Groups in the IBM and Boeing study had an average size of 8, which compares favorably with NN average group size of 10 and an average size of 7 at EADS-M.
- Task characteristics at IBM and Boeing were best described as "problem solving" and covered a wide range of application areas similar to those addressed by NN. Differently, at EADS-M the GSS was mostly used for kick-off meetings exploring goals and boundaries of new projects. Task structure and size varied considerably across the 4 organizations.
- Technology in all four cases was GroupSystems developed at the University of Arizona and commercialized by GroupSystems.com (formerly known as Ventana Corporation). Although operating systems have changed from DOS to Windows, tool characteristics and functionality remain comparable. The studies conducted at IBM and Boeing used DOS-based GroupSystems while NN and EADS-M used Windows-based GroupSystems.
- The participants at all four sites were sufficiently computer literate to participate meaningfully. Their training on the use of the GSS never took more than 15 to 20 minutes. No participant abandoned the technology during the sessions. No participant expressed concerns that they could not participate meaningfully in the meeting.

4. Results

Data for this comparative study were collected from 441 participants in 55 groups at IBM, 654 participants in 64 groups at Boeing, 414 participants in 39 groups at NN and 74 participants in 10 groups at EADS-M. Below we present the results with respect to process and technology, efficiency, effectiveness, user satisfaction, and cost benefit respectively. Detailed accounts of the IBM studies can be found in [18, 24, 29, 35]; the Boeing study can be found in [32]; the NN study can be found in [36]; and the EADS-M data are reported in this paper. All participants' perceptions were on a 5 point scale, 5 being the most positive.

4.1 Process and technology

Findings on interaction, participation, anonymity and parallel working were only available for IBM, NN and EADS-M.

Participants in both organizations agreed on various process and technology aspects. IBM participants felt that in a manual group setting it would be extremely difficult to get the same amount of *interaction* as in a GSS meeting. NN participants rated the extent to which GSS encourage interaction 3.8 while EADS-M participants rated it 3.9.

The meetings logs of the sessions at IBM and feedback from participants suggested that very high levels of *participation* were achieved, and, in addition, GSS were thought to equalize participation. The participants in NN and EADS-M sessions rated the extent to which GSS encourage participation 4.0 and 4.1 respectively. However, some participants at NN also remarked that although the process gave everyone an equal chance to contribute, the electronic discussions were sometimes somewhat impersonal and therefore they did not feel very motivated to participate. This effect was also observed at EADS-M, aggravated by the 'classroom setting' in which some sessions took place.

Members from both organizations were very positive about the *anonymity* feature of GSS. NN and EADS-M participants rated the functionality of anonymous communication 4.3 and 4.7 respectively, and the extent to which they liked working anonymously 4.2 and 4.1 respectively At all three organizations some sessions would not have been possible without anonymity. At IBM and EADS-M people felt less apprehensive to contribute ideas and discuss them openly. Anonymity was considered to be instrumental to achieve a process that lacked intimidation. At NN and EADS-M anonymity was thought to be especially valuable when sensitive subjects were discussed. At NN and EADS-M some participants felt taken seriously for the first time. At EADS-M anonymity was not always used, and once was considered a barrier because the participants discussed critical aspects and all wanted to know each others contributions to have a profound discussion about these aspects. The high rate for the functionality of anonymity at EADS-M was believed to be due to the importance of hierarchy in the organization.

Both organizations subscribed to the notion that *parallel* input of ideas and votes can boost productivity. Both at NN and EADS-M participants remarked that notwithstanding its advantages, parallel communication comes with the risk of overloading the participants with information. The NN participants rated the extent to which they liked working in parallel 4.3, EADS-M 4.7.

4.2 Efficiency

Efficiency was expressed by the participants in terms of perceptions as well as comparison with historical sessions. Some comparative results are presented in table 2. At IBM, participants rated at 3.9 that the session is efficient, at Boeing and NN participants rated 4.0 and EADS-M rated it 4.3. Also, NN participants perceived that "available time was used well" at 4.1 and EADS-M rated it 4.2. In addition, NN and EADS-M participants scored on "this GSS meeting is more productive than a manual meeting" 4.1 and 4.3 respectively.

Additional data was gathered from session leaders. Prior to GSS use, and without knowledge of automated support capabilities, group leaders were required to recommend and document a feasible project schedule for objective accomplishment based on experience with previous similar projects. After completion of the project, expectations before use of the tools was compared with what actually occurred. Person hours were saved in the cases recorded, with an average per session saving of 55.5% at IBM, 71% at Boeing ,53.0% at NN and 49.7% at EADS-M. The same procedure was followed for calendar time savings. At NN, 57.7 % savings was recorded, while at IBM significantly higher levels at 92 % and 89 % percent for two series of sessions were estimated. Also Boeing was higher, at 91%. On the contrary EADS-M was significantly lower, 33.3%. We belief that low calendar saving time is due to the fact that meetings were mostly kick-off meetings and exact time savings were hard to estimate by initiators because there were no similar projects to compare with.

Table 2. Summary of results on efficiency, effectiveness, and user satisfaction.

Aspect	IBM	Boeing	NN	EADS-M
Efficiency				
Session is efficient	3.9	4.0	4.0	4.3
Person hours savings	55.5 %	71.0%	53.0 %	49.7%
Calendar time savings	92 % / 89 %[1]	91.0%	57.7 %	33.3%
Effectiveness				
GSS more effective than manual	4.2	n.a.	4.0	4.1
GSS helps to achieve goals	4.1	4.0	3.9	4.0
Initiator's evaluation of outcome quality	4.4	4.1	3.9	4.3
User satisfaction				
Satisfaction with GSS process	4.1	n.a.	4.1	4.3
Willingness to use GSS in similar projects/activities	4.2[2]	4.4	4.2	4.5

[1]based on 11 and 59 sessions respectively.
[2]for brainstorming activities.

4.3 Effectiveness

Effectiveness was comprised of two main components: extent of goal achievement and quality of outcome. It appears that IBM participants were slightly more positive on effectiveness aspects than NN, EADS-M and Boeing participants, see table 2. At IBM, participants rated at 4.2 that the GSS exercise was more effective than a manual procedure. At Boeing these date were not available, at NN it was rated 4.0 and at EADS-M and 4.1. Also, GSS were considered to be instrumental in helping the group to achieve its goals. This was rated 4.1 for IBM, 4.0 for Boeing, 3.9 for NN and 4.0 for EADS-M. The session initiators' perspective on the quality of the outcomes of the session were most positive at IBM as well, 4.4 compared to 4.1 at Boeing, 3.9 at NN and 4.3 at EADS-M. Yet, overall patterns of perceptions on effectiveness were very similar.

4.4 User satisfaction

All sites scored high on user satisfaction aspects. Both at IBM and NN, user satisfaction with the process was rated at 4.1. At Boeing no data were recorded on this aspect, at EADS-M satisfaction with the process was rated 4.3. Participants at NN and EADS-M noted at 3.7 and 3.9 respectively that the "results met expectations". "GSS was useful for today's activities" was rated 4.1 at NN and 4.0 at EADS-M . Asking whether they would be willing to use GSS in similar projects the participants at both IBM and NN responded 4.2. Boeing rated 4.4 and EADS-M 4.5.

Most data on user satisfaction, however, came from follow-up interviews. Participants at IBM noted numerous benefits over traditional meetings including enhanced group synergism, reduction in participant apprehension, openness of the process, and lack of intimidation. NN participants stated that they liked the immediate availability of meeting minutes, the fairness of the process. They also felt the technology and the way it was applied helped them to better achieve consensus on a number of issues. Meeting initiators stressed that they most appreciated the comparatively higher quality of meeting results. Higher meeting efficiency was less important to them. Yet, at EADS-M efficiency was evaluated as a very important aspect. In some of the projects meeting the deadlines was more important than quality. The GSS enabled them to achieve both quality and the deadline. The immediate availability of meeting minutes was also recognized at EADS-M as very positive.

4.5 Cost benefit

A key element of acceptance the different companies was the relation between the costs and benefits of a GSS facility. All organizations were especially interested in ascertaining whether GSS could provide a measure of savings in people hours that would offset the cost of specially developed facilities and associated support necessary to sustain a long-term program of use.

Based on 64 cases at IBM with 490 participants, $157,315 (1987) of savings were attained, more than enough to recover full annual support costs. The 64 cases were essentially the equivalent of 32 days of facility use, 15% of those available for use over the course of a year. At Boeing, $432,260 (1993)was saved in 64 sessions with 654 participants in total resulting in a satisfying return of investment and a well founded decision to acquire the system. At NN, $143,000 (2001) of annual savings were estimated if 104 sessions were organized. The break-even point for the facility at NN, including personnel, hardware, and software, would be after three years. Annual support costs would be covered by 35 days of facility use. At EADS-M savings of $40,000 (2002) for 10 sessions, more than enough to cover the pilot phase expenses. The annual number of full day sessions to break even over a 3 year period is 28 at EADS-M.

5. Discussion

The number of NN and EADS-M sessions were fewer in number compared to IBM and Boeing. Further, IBM and Boeing tended to use its own facilitators, who were initially trained by the University of Arizona, and quickly developed a stylized form of moderation. This is in contrast with NN and EADS-M which relied solely on Delft University of Technology facilitators who were present during all sessions (although since the sessions reported in the study were held, at both sites internal facilitators have been trained who applied GroupSystems in real sessions).

There are numerous salient issues that arise from the comparison between the four sites. Overall, the results from the studies are strikingly similar. This is particularly interesting given the different nature of the organizations and their employees:

- The studies were conducted in a time span of 16 years. In time the pervasiveness (or lack thereof) of computer technology in general and GSS in particular has changed dramatically.
- All organizations are very different - in terms of basic business interests in general and vested interest in computers in particular.
- All organizations recognized the usefulness of GSS features such as anonymity and parallel communication in spite of significant differences in group-makeup and experience in working together.
- Technology diffusion has continued at IBM, Boeing and NN as they took more responsibility for session initiation and facilitation as time progressed. At EADS-M implementation of the GSS is still in progress.

There were, however, differences in the results that may to some extent be attributed to characteristics of the organizations and their people:

- At the US companies and EADS-M, it was stated that timesaving absolutely represented the biggest advantage of the system. At NN, however, timesavings were not considered most important. Many participants, including session initiators felt that the biggest advantage was the perceived higher quality of meeting outcomes. This may also be an explanation for NN initiators' more critical evaluation of outcome quality than the initiators at other companies. At NN, employees tended to put less emphasis on the importance of facilitation in contrast to IBM, Boeing and EADS-M where employees relied heavily on facilitation before, during, and after sessions. To some extent, this explains the desire, from the beginning, to quickly develop own personnel as facilitators and recognize it as a critical success factor.
- At IBM, a stylized pattern of GSS use quickly emerged i.e., brainstorming, organizing, and vote that varied little as a function of task characteristics. At NN and EADS-M, session agendas were more varied as group leaders and facilitators sought to achieve a fit to difference challenges. The main explanation for this may be the difference between in-house facilitators who are full-time organizational employees (IBM) and those who are brought in more in a consultative role, especially when they are academics (NN and EADS-M). Academics may be more likely to explore and try different things. Corporate employee facilitators may be less likely to explore and less likely to take risks. Consultants can walk away from a failure, employees have to live with it. This is likely to invoke different facilitator behavior with different objectives – not right or wrong but definitely different.
- At IBM, norms of behavior were made very explicit, including an opening screen of "don'ts," e.g., do not criticize during brainstorming. At NN and EADS-M, behavior was more relaxed and varied with no fixed modes of required or preferred behavior.

Neither of the IBM, NN and EADS-M studies addresses longer-term issues of innovation diffusion and organizational institutionalization of GSS such as reported in [2] and [3]. It remains to be seen how examples as reported here affect organizations as a whole. For example, yet to be studied is the impact on the organization of GSS in terms of structuring to meet future needs. At Boeing, the total working process was adjusted to the GSS, leading to a higher level of efficiency but detailed information about the effect on the organization as a whole are not available.

6. Summary and conclusions

There has been a paucity of studies of organizations using GSS in situ, especially in international contexts. Reasons for this are many. It is often difficult to develop trust to the extent that organizations will try new technology. New technology requires attention and expense that often exceed immediate expectations of return. Unlike universities, organizations by nature are not as interested in exploring concepts and have removing uncertainty as their primary focus. Further, it is often difficult to systematically collect data. Organizations are rarely interested in spending time filling out questionnaires or having their data presented in public.

In this paper, we have revisited data from IBM and Boeing and compared it to data collected from NN and EADS-M. Overall, the results are more striking in their similarities than differences. In all studies, GSS provided consistent added value. This is especially interesting given the independent nature of the studies. Much remains to be done, however. Ultimately, it is important to use a variety of approaches to explore GSS application and implications as the technology diffuses in global organizational contexts. The experience from all four studies and this comparative study lead us the following areas of future research:

1. There is a need for studying the application of GSS that goes beyond one or a few sessions. Relatively little is known about the way in which groups can use GSS consistently in lengthy projects. Moreover, there is a need to study organizations were GSS have or are about to become an embedded part of the organization's primary processes, such as software companies and educational institutions. Although all organizations have adopted a GSS, more research has to be done about how to use the GSS on a regular basis as a part of standard processes instead of using it as an ad hoc tool for unique sessions or problems.
2. All companies have multiple locations, all are international, therefore research on distributed sessions would be interesting and useful. GroupSystems.com has developed an online version of GroupSystems, which offers the same functionality as the meeting room version. The research model and focus of the studies presented in this paper could function as a blueprint for research into distributed collaboration so that differences in participant perceptions between the two collaboration modi can be illuminated and investigated.
3. Finally, it would be advisable to develop a framework for studying the organizational application of GSS so that the results from various studies become comparable. Such a framework would have to look at various aspects of GSS use in organizations, such as group behavior, performance, cost/benefit, and adoption of technology over time.

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