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Adoption of web-based group decision support systems: experiences from the field and future developments

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Abstract:

While organizations have massively adopted enterprise information systems to support business processes, business meetings in which key decisions are made about products, services and processes, are usually held without much support of information systems. This is remarkable as group decision support systems (GDSS) seems to fit for this purpose. They have existed for decades and modern versions benefit of web-based technologies, enabling low cost any-place, any time and device independent meeting support. In this exploratory case research, we study nine organizations in four different adoption categories to learn more about the reasons for the relatively slow adoption of web-based GDSS. Using the Fit-Viability adoption framework we conduct interviews with organizations that have experience with using GDSS. We conclude that adopting GDSS requires considerable and carefully planned change of processes that are deeply grounded in the organization. Existing meeting routines need to be adapted. Introduction needs to be carefully planned and room for face-to-face meetings and creativity sessions away from the keyboard need to be built in depending on the type of meeting. Not all companies find the cost level affordable. Clear and convincing business cases are lacking. Still the added value is ranked highly and there are frequent and enthusiastic user organizations that may lead the way for others. Their success stories show others how to mitigate problems.

Keywords:

adoption; implementation; group decision support systems; collaboration; meeting support systems; GDSS.

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1. Introduction

While enterprise information systems have been implemented by virtually all modern businesses, the adoption of automatic support for group decisions has lagged behind. Commonly, information from enterprise systems serves as input to business meetings, but the meeting itself is still held with very limited or no support of information systems. Around the world, on an average day, millions of such meetings are being held. Studies indicate that considerable time is wasted in these meetings, estimating 35% [1] to even over 50% of lost resources [2]. Research into effectiveness of meetings show that employees appreciate meetings with a clear structure and meetings that accomplish something meaningful and do not look forward to meetings that are unstructured, start late and do not lead to results [3]. Group Decision Support Systems (GDSS) seem to address exactly what is needed to have effective meetings, promising to provide structure, effective information exchange, idea generation and organization and support for effective decision making, even if participations cannot be present on-site. So why most meetings still are held without support of a GDSS?

1.1 Evolution of Group Decision Support Systems

Several studies have addressed this question and we will review exemplar studies and survey the results of systematic reviews in this area. However, it is important to realize that most of these works deal with earlier generations of GDSS. The current generation of GDSS, by making use of Web based collaboration and Software as a Service concepts, seems to substantially lower several known barriers to GDSS adoption. The emergence of these new GDSS are the key motivation for our study.

Watson et al. [4] describe a GDSS as a combination of computer, communication and decision support technologies to support problem formulation and solution in group meetings. They define the goal of a GDSS, based on many sources, as to reduce process loss. Process losses are all interactions within the group that slow down the process of making a decision. These include disorganized activities, dominant members and social pressure. Using a GDSS enables a clear structure in the decision making process. It supports to generate, clarify, organize, reduce and evaluate ideas. The structuring often helps to make the decision making process more efficient and effective and delivers an added value for the organization [5].

A traditional GDSS session is done with all participants in one room. Ideally, everyone is sitting at a table in a meeting setup. All of the participants have a computer in front of them which is used during various stages of the session. The session is led by two people. The first one is the technical facilitator. She/he makes sure all technical issues are taken care of. His job is to answer question from participants regarding their personal systems, operating the main system during the session and process all input from the meeting into the system. The session itself is led by a process facilitator. S/he plans the session and is the leader during the session. Her/his role is to make sure the group is progressing through all the phases in a rigid and sound manner.

The session starts with an opening statement by the process facilitator. The goals and plans for the session are explained and, if necessary, an introduction to the GDSS is given. A typical session then starts according to the funnel model (see Fig. 1). This model shows how the answers are processed by the group through consecutive phases. As the meeting progresses, the number of ideas is decreased through categorization and prioritization, while, if done correctly, the consensus within the group increases [4], [6].

The first phase is the Inventory phase. In this phase every participant is asked to input his ideas into the system. This can be done freely and without any obstacles. During the Categorization phase the facilitator takes the lead. The participants are asked to neglect their systems for a moment and join the group conversation. All input is shown and guided by the facilitator while the group categorizes the input. This means doubles are taken out and more or less the same answers are combined in to one. This process is mainly performed to make the next phase easier.

In the next phase, the Prioritization phase, the undoubled ideas are prioritized by the participants. How this is done differs per session, but these techniques include ranking and scoring of items. This is done by every user individually and when they are finished the results are consolidated. The aggregated result is presented by the system as the suggested decision. Naturally, it is not the objective of a GDSS to automate decision making itself. A GDSS only provides the participants with an objective presentation of their opinions. The final decisions however should have a broad support in the group, because of the process arriving at the ultimate outcome.

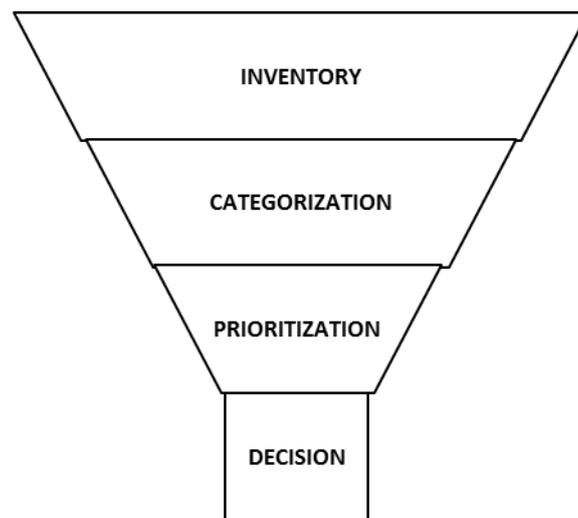


Fig. 1. The funnel model

During all phases of the session, the facilitator can make several choices. The first choice is if and when to show the given input on the big screen in the front of the meeting room. The answers can be shown during, e.g. the inventory phase, in order to inspire others for new ideas. Also it might help to reduce the number of double inputs for the next phase. An argument for not showing the ideas on the screen is to ensure a tunnel vision is avoided.

The second decision that needs to be made, is whether or not to show the names of the different authors. Showing the name makes it impossible to hide from personal input. This makes participants think about the quality of their input. However not showing the names eliminates the political games that may be going on within the group. An idea provided by a manager might be scored better, just because of the author, as people might be afraid to be critical [7].

The session described above is the most basic session that can be held with a GDSS. The software is capable of supporting various ways of working. The example session is an example of a same place, same time session. However by use of the phased approach and the internet, new opportunities arise. The same session structure can be maintained in a different place, same time structure. This requires, besides an interface with the system, a video or audio connection with the other location. This allows for example global team to make use of the system. However, in some cases it might be hard to collect the complete group at the same moment. When this is the case, an asynchronous session can be organized. In an asynchronous session, the facilitator sets up the first phase and invites all participant to collect their ideas into the system. The participant can do this wherever they want; at a set place (same place, different time) or at a place of their liking (different place, different time). When everyone has completed the first phase, the facilitator checks the results and initiates the next phase. This continues until the process is finished.

1.2 Studies into adoption of GDSS

De Vreede et al. [8] review some GDSS field studies and their findings. These report largely positive experiences such as higher perceived and measured meeting effectiveness and efficiency, improved meeting outcome quality, high participant satisfaction. However, also a lack of increased performance was reported. Some organizations reported abandonment of the GDSS due to a lack of frequent use. Also, too little support for debating and negotiations was observed by some adopting groups. De Vreede et al. [8] in their own field studies confirm the usefulness of GDSS features such as anonymity and parallel communication. They conclude however that more longitudinal research is needed to get better insight in the diffusion and success over longer periods of time. Also, they recognize that the computer technology and GDSS in particular continues to change dramatically, partly making results of earlier studies less significant. Fjermestad and Hiltz [5] evaluated 54 case and field studies and concluded that there are several elements contributing to the successfulness of a GDSS implementation. The use of a facilitator (the session leader), the number of sessions, the amount of training and kind of tasks performed are found important. Still, limited adoption and failures of GDSS use have been reported [9]. The authors find that improperly designed GDSS sessions, technology breakdowns, unskilled participants or facilitators are frequent causes of such failures.

Today, more than a decade later, for most professionals it is still exceptional to be part of a meeting that is supported by a GDSS. While the use of Internet, mobile technologies and social media have become commonplace, GDSS remains a rare commodity. Modern GDSS have benefitted from advances in hardware, software and network technologies. They now typically run on various devices using web-browsers as their platform in a Software as a Service (SAAS) delivery model. Sessions and data are stored in the cloud allowing participants to take part in a meeting any place, anytime. New devices such as smart phones and tablets have been massively adopted and allow virtually any knowledge worker to use a GDSS. While there are many, partly free, tools on the web that provide part of the typical GDSS functionality, full featured GDSSs continue to be the domain of a limited set of specialized vendors. A GDSS provides a comprehensive set of functions to support all phases of a meeting. The participants are taken through the inventory stage to the categorizing and prioritizing stage, the so-called funnel model. This ultimately leads to a decision by the group.

This paper aims to address the question why still so many meetings are held without a GDSS. More than 30 years after the developments of the early GDSSs, the technology seems mature. Why is the adoption of GDSS by organizations so low? What can organizations that plan to adopt GDSS learn from current experiences? The next section introduces the adoption model we use in this study. Then, we explain our research method, the results from the case studies are shown and conclusions presented.

1.3 Models for GDSS adoption

Several models can be found in the information systems literature to study the adoption of GDSS. DeLone and McLean view systems, information and service quality as key variables that impact intended use, use and user satisfaction and ultimately net benefits to the organization [10],[11]. The Unified Theory of Acceptance and Use of Technology (UTAUT) combines elements of several theories and researches on the adoption of information systems by individuals. The UTAUT model makes a distinction between four key constructs for the behavioral intention and use: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. Both the expectancies are about the beliefs of the user that use of the software will help her/him in the job and the belief of being able to use the software without a big effort. Social influence is the degree to which an individual perceives that important others believe he or she should use the new system [12]. These constructs however are not equally important for every user. There are four variables influencing the impact of each construct: Gender; Age; Experience; and Voluntariness of use. Not all variables effect each construct, as can be seen in the UTAUT model.

The classic Diffusion of Innovations work by Rogers is also relevant to the adoption of GDSS. Rogers defines five stages in the Innovation-Decision Process [13]. In the first stage the individual has been exposed to the innovation, but does not take action to learn more about the innovation. In the next stage s/he starts to get interested and actively seeks for more information. When enough information is gathered, the third stage is entered and the individual decides

whether to adopt the innovation or reject it. In the next stage the innovation is used in some way and judged for its usefulness. In the last stage the decision is finalized. Looking from a higher level several types of users can be distinguished, each in a certain state of maturity. In the curve the level of adoption is plotted against time. Each of these user groups has its own needs and wishes. The GDSS software as it is used now, is located in the innovator or early adopter phase. This means the level of adoption is still low and it has only been adopted by organizations who are willing to try this new innovation (take a risk).

A recent framework tailored to studying the adoption of the newest generation of collaboration tools (so called Collaboration 2.0) is developed by Turban et al. [14]. They combine elements from several adoption theories and integrate them into a framework to study the adoption of Collaboration 2.0 tools, aimed at group decision making. According to the authors the ease of use of current tools is higher and costs of use are much lower than their predecessors. Web-based collaboration tools offer more interaction and flexibility. They state that adoption of GDSS is based on two things: Fit and Viability (Fig. 2). The Fit component focuses on the firm's needs, core competencies, structure, value and culture of the organization. The decision making tasks and nature of the group are "checked" against the chosen tool, in our case a GDSS. The Viability part consists of three elements; First, the financial element, where costs for maintenance, training and acquisition have to be compared to the value of the tool for the organization. Second, the IT infrastructure is an important element. This involves all infrastructures necessary for running the software, for example, server configurations and security upgrades. In case of a GDSS there is an option of using the supplier's servers for hosting the session. This considerably lowers the requirements for infrastructure. Third, viability to the organization is a relevant element. The users need to see the benefits of the software for their tasks. The fit can occur, but it has to be acknowledged and be observable and measurable.

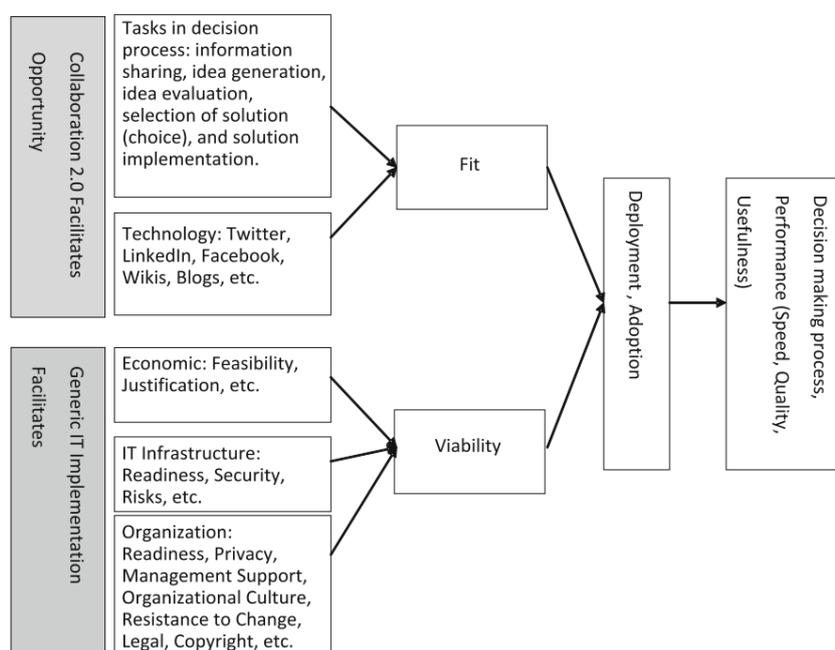


Fig. 1: A Framework for Adopting Social Networking Software for group decision support [14]

The remainder of this paper is structured as follows. We first present our research method. Next, we present and discuss the results for various groups of GDSS users. Finally, we present technology developments that will have an impact on GDSS and its adoption and give our conclusions and limitations of the study.

2. Research method

In this research the Fit-Viability theory discussed in the previous section is used. It is very suitable for this research as it lists a wide range of explanatory factors so that the cause of adoption or non-adoption can be explored taking a broad viewpoint. Moreover, it is explicitly designed for studying the adoption of collaboration 2.0 tools, a category to which modern GDSS belong. In order to reveal the reasons for not adopting GDSS on a larger scale, we conduct a number of case studies using the following steps. First, criteria for participating companies were set for each of four groups. The first group is the group of frequent GDSS users. The second group are non-frequent users. These users are seeing the benefits of using a GDSS, but are not using it very often. The third group acquired a GDSS, but stopped using it. The final group had a demo session with a GDSS, but decided not to buy one. An interview guide was created consisting of a protocol and semi-structured questions. Next, companies in each of the four groups were invited to participate in the research, interviews were held and analyzed. To make sure the research would not only show the flaws in a certain GDSS, the users of two different GDSS systems were interviewed: Spilter and Group Support. These two companies are responsible for about 90% of the Dutch GDSS-market. An adopting organization was interviewed from each group and for each of the two GDSSs. There are thus two results in each category of organizations. In the low adoption group, three organizations were interviewed, which brings the total to nine case companies.

The first step of the research was to select case companies. It was decided to invite companies from various industry sectors. GDSS vendors Spilter and GroupSupport each provided a sample group. The first part of the interview was aimed at gathering knowledge about the interviewee. The following questions were included:

- What is your function and what tasks are you performing?
- What experience do you have in using GDSS?
- In what kind of meeting are you using the GDSS and what role and rank do the participants have (e.g. board member, manager or operator)?
- How did you get interested in GDSS? (Non-user question)
- What did the decision process to acquire a GDSS look like? (Current and ex-user question)

In the next part of the interview the Fit component was discussed. Firstly the fit between the task and tool was explicitly discussed: What are the benefits of using a GDSS and where does the tool not comply with the task? Also the participant was asked for the perceived value of the tool. Does the tool accelerate the decision making process and is the quality of the decisions any better using the GDSS? At the end of this section the participant is asked if he/she perceives that the GDSS has added value and if a “normal” session or a session with a GDSS is preferred when given the choice.

The third section of the interview is about the Viability branch of the Fit-Viability model. First the financial cost-benefit analysis is made. What costs does the GDSS imply and what benefits does it entail? Next, it is interesting to know if the participant believes these benefits are greater than the costs. Then the organizational readiness was reviewed. Possible IT problems were identified. Was there any new hardware needed for using the system and was the organization technically ready for the new system? Besides this the participant was asked if he/she believes the use of the system is problematic for his/her colleagues. Next, the implementation was discussed: What implementation strategy did you use and what problems came up during the implementation process? If there were any problems, more details about their nature and impact was asked, and how the problems were addressed. For the non-GDSS users there was one last question: Why did you decide not to purchase a GDSS? Also, the ex-users were asked why they decided to stop using the system.

At the end of both the Fit and Viability part, a series of propositions was used to verify our analysis of the answers to the interview questions. These propositions revisited the topics that were touched in the interview questions before and made it possible for the interviewer to check his interpretation of the answers. The interviewee was asked to rate a certain proposition from 1 to 5, 1 meaning “completely disagree” and 5 “completely agree”. This way

miscommunication could be detected earlier. If, for example, the interviewee used the word “great”, this could have a completely different value to the interviewee than to the interviewer. The interviews were conducted and analyzed from the end of 2012 to early 2013.

3. Results

This section summarizes the results of the interviews. Each summary starts with a short description of the participant and her/his working environment. Then the outcome of the interview is presented.

3.1 Frequent users

Participant1 is employed at a large consultancy firm. Her first experience with the system was while working on an assignment as a consultant. The business now provides about 35 sessions per year. Roughly four kinds of sessions can be distinguished: creative sessions; strategic sessions; risk assessment; and “create order”. These sessions are mainly attended by highly ranked managers discussing tough issues. In this situation the use of a GDSS provides several benefits. The system very clearly shows what has been discussed and shows those subjects which need further discussion. “Accelerate where possible, to decelerate where you have to”. This leads to better consensus, which leads to more support towards the outcome of the session. But there are some concerns. During the session the role of the facilitator is crucial. The facilitator has to decide what the desired outcome is and what questions need to be asked to gather them. This leads to a more carefully prepared meeting and better outcome. It is also important to realize that the tool is not the only option in the world. Sometimes it is better to take another approach to solve the issue. This is something the facilitator has to assess. During the session it is important that the facilitator makes sure everyone goes along with the session. The suggestion that maybe key positions in the organization might be occupied by the kind of managers that need the traditional model is denied instantly. If the manager would not want to know the opinion of his employees, there would not be a session. There are some other causes that lead to resistance. The use of new technology always makes people anxious. Also the use of a computer or tablet can be distracting and the transition from a verbal discussion to electronic voting can be a bit unnatural sometimes. Looking at the costs there are license costs, write-off on the used hardware and the costs for the facilitator and the coordination. These costs are compensated by several benefits. Use of this tool allows for more branding and it even brings new customers to the company. This advantage is largest in cases where many stakeholders are involved. “It is a nice and effective way of meeting”.

Participant2 is also working for a consultancy firm. He has a lot of experience in the use of GDSS. His first experience with a GDSS was during his study at Delft University. As a student assistant he was responsible for the technical support of the session. Later on he became a facilitator and did lots of research on the success and quality measuring of GDSS sessions. Nowadays he is working as a consultant and also as the project manager for the GDSS. In this role he tries to “sell” the GDSS to his colleagues and get them ready for taking the tool to their clients. The system is used two to three times per month. Use of the system really speeds up the decision process. He finds that the easier voting and possibility to work simultaneously really speed up the process. But the biggest advantage is that use of the system forces you to prepare the session more extensively. Participants in the sessions like the fact that the session enforces a certain structure which is clear from the beginning. This does not mean that everything has to be done in the system. There still has to be a human contact, the system is just an aid in getting to the desired outcome. “I always try to make a 50-50 diversion between using the system and discussion. Otherwise people could just have stayed at home”. According to the participant this is one of the major problems for the system. People think that use of the system eliminates all contact during a meeting, but in a properly organized meeting this is surely not the case. Besides this there are some other issues. Use of technology in general scares people, so it is hard to build any trust in the system. If a person has one bad experience using the system, all trust is gone and can hardly be restored. But most of all it is hard to accomplish the needed mind shift. People have been working in a certain way for a long time and changing this is really hard. Preparation takes more time and some specific process skills are required. The facilitator has to sense the group and lead them through the process. This scares away people. Within the company two portable sets are used to host

sessions. This gives two additional obstacles: transportation costs and the need for a second person to do technical support.

3.2 *Less frequent users*

Participant3 is working at a special unit within the Dutch government. This unit has resources for hosting a session, of which the GDSS is one. The participant is a technical facilitator. He is involved in all technology used by the unit. The sessions in which the GDSS is used are very diverse. A great benefit is that everything is recorded and shown to the group immediately. Meetings go faster and better and also more ideas are produced. Although this participant is an experienced and enthusiastic user, he does not always prefer to use the system over a whiteboard session. Which method is used depends on the session. "To have someone working with the system all day is not always good". This is probably why the system causes almost no trouble: it is only used when it's beneficial.

Participant4 is employed at a large Dutch telecom provider. Until recently he was working as a consultant for companies outsourcing towards his company. From that point he started working on optimization of the decision and internal processes. At the moment the GDSS system is used for internal and client meetings. The participant is working as a facilitator. After a few sessions people got enthusiastic by the enormous productivity boost. "If properly applied, it can lead to an efficiency gain of 75%". This reduces both costs and time needed. People feel the need to make their statement. This need becomes bigger as they become higher in the organization. Normally this takes a lot of time, but using the system they can do this simultaneously. During sessions the role of the facilitator is crucial. There is a small amount of meetings that follow the prepared agenda, but most meetings do not. In these sessions opinions can be so far apart that preparing is not possible. According to this participant there are several possibilities why this tool does not make it to the big public. The tool should be presented in the right way at the right time. Here the role of the facilitator comes in again. The facilitator has to feel what the group wants. Sometimes it can be useful to split up and work in separate groups or just take a break. People are scared that use of this technology will take away the human interaction. For some reason technology is seen as something individual. Finally a mind shift is needed. People can no longer make a point based on verbal skills. This might even ask for another kind of manager.

Participant5 is working at an IT-consultancy firm. As a consultant he specialized in education. His first experience with a GDSS was as a participant. He was very enthusiastic right away and saw the possibilities the system offered. Now he has worked a lot with the system, but within the company he is now employed they do not use such a system. The participant is now trying to work it in to the company so that his colleagues can add it to their toolbox. This process is not going very fast. The past year he tried to slide in the system at several occasions, but every time people are slowing down and rejecting the offer. There is a fear that creativity will be lost when using the system. That's why he tried a combined session of flip over idea generation and ranking and scoring using the GDSS. Reactions to the demos are pretty positive, but eventually nothing happens. Benefits of the system can be found in a quick insight in results and automatically generated reports. It also gives an innovative image to the company and creates an advantage with respect to the competition. Clients see the system as positive and refreshing, participants in a session enjoy doing it. The main reason for the lack of adoption is the prejudices. People are afraid of working with technology and changing their habits. "Going on as it is done now provides more security and takes less time than trying something new". Deploying a GDSS does both.

3.3 *Former users*

Participant6 is employed at a big transport hub in the Netherlands. In particular the brainstorm sessions went much better with use of the system. A great benefit is the fact that no one can put his stamp on a meeting. Rank or status no longer counts, every idea has the same value. An idea gets judged by its value and not by its creator. Also the parallel working speeds up the meetings a lot. If everybody shows commitment to the system it has a great benefit in time and quality. But people value the conversation very much, so they are scared that it will disappear. The participant endorses that this sometimes happens, but also thinks that it creates a little time to think and that it is partly compensated by the possibility to see each other's answers. A major problem is the lack of integration with the rest of the systems. It is not

possible to integrate Microsoft Office documents in the session. This is something the training really needs. This was now done by changing screen, but people found that annoying to do. Besides this reason, there are two other reasons for the exit of the GDSS. The first one is financial. Now it is no longer used in training, the costs per use became too high. The other reason is political. The incident control team is a combined force of several agencies, of which the Dutch government is one. They decided to use another system, so the use of the GDSS drops even further. When a good alternative, part of the Microsoft office package, came along, they started to use that.

Participant7 used to work at the R&D department of one of the GDSS vendors. Then he transferred to a starting *spinoff* related to a Dutch university. The spinoff used this system from the start, mostly doing “normal” sessions. According to this participant, especially the converging tools are very strong. The diverging, collection of ideas, can be done by other tools as well. The system created a time improvement through parallel working. Deployment of the system generated new clients and made them come back. People experienced the timesaving and found it fun to work with the systems. Whether the systems created a quality boost is not sure to the participant. He never did the same session twice, so he finds it hard to compare it to a brown paper session. This participant also emphasizes that the facilitator plays a very important role. The facilitator needs a lot of experience using the system as well as hosting sessions. This is according to the participant the main problem for adopting a GDSS: it is facilitator driven. The need of a special facilitator combined with the extra preparations create a problem for easy adoption. “It really is a tool for consultants”. The reason for stopping had nothing to do with the GDSS itself. As the business was stopped, so was the use of GDSS.

3.4 Non-users

Participant8 is employed at large insurance company. Within this company there is a special unit hosting all kinds of workshops. He is responsible for this unit and is also an active facilitator. In this workshop center there are several options for hosting a session; there is a room completely covered with whiteboards, but also music, movies and creative materials (e.g. paint and Lego) are used. The intention of the research was to find out if a GDSS could be an addition to the current options for hosting a session. She is convinced that under certain circumstances the system could function very well. In her job she looks over all incoming request and assesses if a session in her center is the right way to go. Most of the time the target is to create support or to speed up a certain process, but a joint session also generates more ideas than when everybody is working on his own. According to the participant the tool fits its task very well. The system could be very well used in the inventory and clustering phase, maybe also for the first step of prioritizing or voting. It would be very important that people stay verbally connected. Everybody should share and explain their preferences. An advantage during the inventory phase is that this can be done asynchronous. This saves time, as does the automated report function. This timesaving directly creates a financial win, this because the session time is reduced. The anonymity given by the system will possibly lead to a higher output because people feel freer to present their ideas. Whether this would create a quality improvement is not sure to the participant. Some people like focusing on their laptop, others just do not like this. The final decision to not purchase the GDSS was based on the financial aspect. In this time of economic crisis every purchase is assessed very carefully. Although the system could give a new boost to the unit, the license cost and the costs for additional hardware were too high. There was also a personal motive. Being allowed to use a tool like this involves a bureaucratic process which requires a lot of time and energy, which were not available. Besides this the participant found it frightening to change all her working processes.

Participant9 is working as a staff member at an education group. As part of his job he is responsible for making a year plan involving many subjects and shareholders. The participant had attended a workshop in which a GDSS was used. The tool fitted this task perfectly, determining the structure and content of the sessions was harder. Use of the tool would be no problem for the specialists and experts, but there’s also a group that would rather not use the tool. This is because the tool provides much more transparency and makes people more aware of content. People who are now defending their self-interest will not like this. And if these are the people guarding the money, the system will not be introduced. Now this was not the case, it was a timing issue. The project in which the GDSS should be introduced was connected to another project. This had already started and fixed several points in the plan. So with the project partly established the introduction of the tool was postponed. It was postponed because the participant does see several benefits in using the system. Experts and specialist often feel unheard and see the system as a great platform for their

points and ideas. The automated reports are also a benefit. In these reports nothing goes lost and the systems creates them very fast.

3.5 Propositions

As mentioned before, interviewees were asked to give their rating on a set of nine propositions. The scores were used to verify the interpretation of the given answers. Although these scores do not enable any quantitative analysis, they present a result that matches the qualitative analysis above. The used statements are the following:

1. The tool fits well with the job I want it accomplish.
2. The tool is user-friendly.
3. The quality of my decisions is better with the use of a GDSS.
4. With the use of a GDSS my decision speed is higher.
5. Purchasing the system is affordable.
6. Use of the system does not require any specialties in the field of IT.
7. The system is for participants, after a short instruction, quickly usable.
8. The implementation of the system went effortlessly.
9. Use of a GDSS in total is an added value for my business.

In Fig. 2 the mean scores for each proposition are given and the extreme values. Because the non-users were unable to score some of the propositions, the n-value of five of them is 7 instead of 9. It can be seen that all scores are relatively high. This suggests that all participants are pretty positive about the use of GDSS. There are two scores that need an explanation. The first one is the 1 given by one of the participants for the affordability. This participant, *Participant6*, thinks that the license costs are pretty high, especially when calculated per use. This is one of the reasons they stopped using the system, so he scored this 1. The second one is the 2 scored by *Participant8* for specialties in the field of IT. This score was given because for the use of the system a set of laptops needed to be purchased and the GDSS needed to be accepted in the current IT environment. So this was rated insufficient, but fits with the answer given.

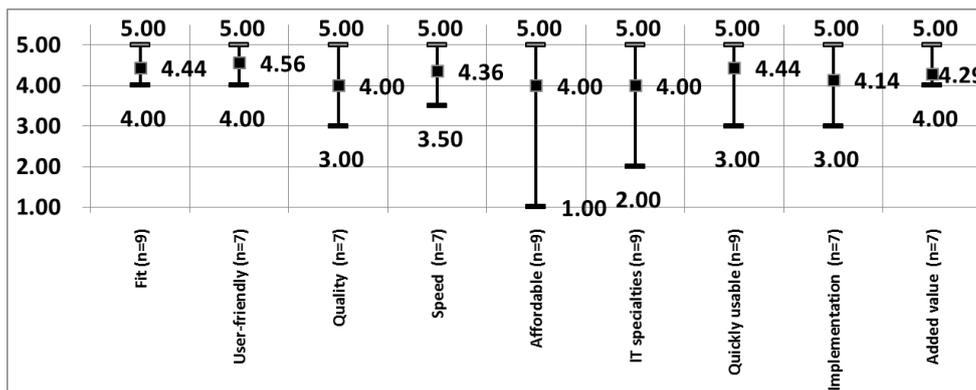


Fig. 2 : Scores by Interviewees on the Propositions

4. Discussion

4.1 Factors slowing down the adoption

Looking back at the results, some possible explanations for the low adoption of GDSS can be found. The first one is fear, especially the fear of change. The interviewees suggested that people seem to be scared to put their current methods aside and start using the GDSS. The current meeting culture allows people to participate in a meeting a bit more relaxed. Their discussing the matters at hand over a cup of coffee. Now the meeting is a lot more structured and requires more attention from the participants. Also the chair of the meeting needs to put in a lot more effort in preparing the meeting than “just put together an agenda”. Executing a successful GDSS session asks for changes in the way people work now. This is a part of the working culture and is not easily changed.

Another possible explanation can be found by the early adopters. As mentioned by three participants, an enthusiastic adopter might try to use the tool in every occasion, even were it is not suited to use it. An important part of preparing the session is to select the most suitable work form to achieve results. This sometimes might mean the GDSS has to be put a set. Especially when the system is newly introduced, it is crucial to select the proper meeting for displaying the system. Trust in the system is hard to build, but very easily destroyed. *Participant4* even suggested that the overenthusiastic adopter might scare people away. He suggested the same thing as could be seen at Apple iPhones. Owners of an iPhone telling all the time how great their phone is, made other people dislike the phone. Not because of the product, but because of their feelings.

The GDSS is mentioned to be perfect for running a brainstorm session. At the same time many people believe that working with the system disturbs the creative process. Three participants mentioned that the switching between the creative thinking and working with the computer might be a problem. Working with the system requires a structured and systematic way of thinking, whereas the brainstorm tries to provoke an unstructured, loose way of thinking.

There also is the fear of losing the dialogue during the meeting. This is a real concern in using the system. As people are sitting behind a screen, it is very easy to hide from conversation. This requires extra attention from the session leader, by choosing suitable work forms to keep the group communicative, and from the participants themselves. Being aware of this problem, they can keep themselves and others from doing this.

Another obstacle in the adoption of GDSS is the economic crisis. At the moment many companies are only investing in things that are necessary for their business or have an immediate effect on their profit. A GDSS is neither of them. It can improve the internal meetings by supporting faster and better quality decisions. The deployment of a GDSS in a consulting setting might also be an advantage in winning orders. However, these are all indirect benefits from the GDSS. From a business view, the system has no necessity (meetings can be held without it) and the benefits are indirect. This might be an explanation for businesses not taken the leap.

Finally, one last explanation was found. It was noted that almost all interviewees mentioned that the system is seen as innovative, refreshing and a nice new way of working. This is kind of a surprising typology of the GDSS as it is a technology which exists for almost 30 years. This might indicate that the system has a problem with its publicity. This could implicate that the system, besides its above mentioned obstacles, is not well known enough by the right people.

4.2 Key to success

All nine participants mentioned the role of the facilitator to be very important, if not most important to the adoption of GDSS. The importance of the facilitator can be found in every aspect of GDSS use. It start by selecting the right session and the right group of participants. As mentioned before, some combinations could better be avoided depending on the familiarity with GDSS.

In the preparation of the session, together with the one responsible for the content, the facilitator needs to make a good plan. Which options and techniques of the system need to be used in order to get the optimal result. This is also the

main objective during the session. The facilitator has to work with the group intensively in order to have them perform optimally.

5. A look into the future

As we observed earlier, computing and network technologies in general, and GDSS in particular, continue to evolve rapidly. In addition, users slowly become more proficient in using advanced software systems. Hardware devices with built in touch screens, webcams, wireless connectivity and ample processing power have become ubiquitous. Intelligent software applications increasingly succeed in using artificial intelligence techniques to support expert users. These technologies will continue to impact GDSS and its success and diffusion. Research as presented in this paper therefore is in need of continuous replication and extension. In our view after three decades of GDSS we are still only at the beginning of the ride. Below, without claiming to be exhaustive, we highlight a few of these developments.

5.1 *Enhancing the user interface*

GDSS vendors have been struggling with the tradeoff between feature richness and ease of use. GDSS are currently being extended with smarter user interfaces that offer various modes of usage (beginner, expert) or adapt intelligently to the skill level of the user.

One of the vendors engaged in this research recently launched a new session form. This type of session, called the hybrid form, tries to make a connection between the digital tool and an offline session. This is done altering the structure of the session after the inventory phase. In this work form, the collected ideas are printed onto stickers which are marked with a QR-code. The ideas then are processed offline, just like in a regular brown paper session. When all sorting and prioritizing is done, the session leader uses a special app to scan all the answers and the place, including the group they are sorted to. The session can then continue as normal. This solution copes with the problem people tend to have with working digitally. By using this offline techniques, people should feel more comfortable in working with the system.

At the same time, new devices such as large sized multi user touch screens and touch tables at affordable prices open up a whole new area of possibilities for GDSS. New devices such as the Oculus Rift or may enable a whole new class of GDSS that enable distributed collaboration [15]. Mobile robotic telepresence (MRP) systems incorporate video conferencing equipment onto mobile robot devices which can be steered from remote locations [16]. MRP can further enhance the virtual presence of members taking part in a remote meeting, e.g. by allowing them to 'walk' around and talk to participants that are physically present.

5.2 *Facilitator as a Service*

Another idea is Facilitator-as-a-Service. The lack of a skilled facilitator is often hindering GDSS success. As Kolfshoten et al. [17] describe: "Skilled facilitators, however, tend to be expensive. They either have to be trained in-house, or hired as external consultants. Therefore many teams who could benefit from facilitation interventions and from GDSS must often manage without them". Both the provided options are quite expensive. Therefore businesses may profit from a service based facilitator. The facilitator as a service might be present in a session using a video conferencing method. This makes skilled professionals from all over the world available to all companies. By using a teleconferencing tool, the facilitator saves travel time and costs, which also allows for lowering the fees as the facilitator can do more sessions per day. This idea also suits the asynchronous sessions very well.

Providing more companies with easily accessible facilitators might very well help the system to become more popular. As stated before, the facilitator is one of the most important factors in a GDSS session. Having companies see the added value provided by the system, will probably help the system in becoming more known and used.

5.3 *Intelligent software assistance*

Currently, especially in sessions with larger group sizes, the clustering of ideas can be labor intensive. Researchers are currently experimenting with automatic cluster algorithms that could relieve the group and facilitator partly from this task by presenting various clustered idea sets [18].

Another drawback of the current generation of GDSS is the lack of support for negotiation. A separate class of specialized systems is being developed addressing this issue. In future versions, negotiation support could be integrated in the GDSS [19].

As the facilitator role is critical but required skilled and scarce resources, the knowledge required could be captured and partly automated. The thinklet concept has been proposed and is similar to design patterns. It offers parameterized action representation of transferable, reusable, and predictable building blocks for the design of a collaboration process [20]. Based on successful thinklets, facilitation support systems could be integrated in GDSS to further enhance the collaboration.

Finally, smart integration of social media into GDSS seems a promising direction. The availability of social media can enhance the group decision process by both integrating social media functionality and platforms into GDSS. The rise of social media tools and techniques has also accelerated the development of new tools such as sentiment and opinion mining algorithms [21]. These can also find their way to GDSS to enhance their functionality.

6. Conclusions

We used the Fit-Viability model to study adoption of GDSS in various organizations. This model provides a lens to study the GDSS adoption phenomena rather than a basis for quantitative explanatory analysis. As such, it was a good fit to the purpose of our study. The results show that several factors play a role and often the 'story' behind the success of GDSS in an organization seems more important than the precise evaluation of the meeting productivity or GDSS business case as the data for making such assessments is missing.

The fit of the task to the GDSS needs to be checked before deploying the GDSS. This is an important task for the facilitator. In the Viability part there are several factors that explain the currently low adoption. As GDSS have no proven effect on results, there is no drive to purchase one. This also influences the IT Infrastructure part, as some of the participants had to buy IT hardware to run the system. Also there are some possible explanations linked to the Organizational factors in the model, mainly the Readiness and the Organizational Culture.

Based on these results, some lessons for the newly adopting businesses could be drawn. As stated before, the facilitator is very important in the use of a GDSS. The costs and effort needed to train someone for this job are a crucial investment for the success of a GDSS. The process of trust building is guided by this person. Picking the right meetings and people for the early sessions creates support for the system and its capabilities. We have reviewed several promising developments in GDSS in three categories: (1) Enhancing the user interface; (2) Facilitator as a Service; and (3) Intelligent software assistance. As these technologies mature the GDSS adoption landscape will continue to be impacted. Studies into adoption of GDSS will therefore continue to be relevant.

There are some limitations to this study. This research only studied organizations that are familiar with GDSS, being only a small subset of all full potential of adopting organizations as GDSS is still in the early adopter phase. Another remark is that this research is based on a relatively small sample of nine in depth case studies. When more organizations get involved in GDSS we aim to repeat this research using larger samples. Although it was not possible to get statistically significant results, many similarities can be found in the stories of the early adopters. Organizations that consider to adopt modern web-based GDSS may find the lessons learned in this study of useful to plan a balanced and successful introduction of these systems.

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