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**The Effectiveness of a Facilitated Group Decision Support System  
(Decision Conferencing): A UK/US Field Study**

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## ABSTRACT

The increasingly complex and turbulent business environments of these days frequently require greater specialised knowledge pertaining to the issues, which are usually beyond that of any individual. Therefore, group meetings are becoming more complex, more frequent, and more important. As part of the transition into this new environment together with recent advancements in computers, telecommunications and management science techniques, organisational researchers have made serious efforts to use advanced technologies to improve group meetings. An example of such attempts is the development of a Group Decision Support System (GDSS), an application of information technology to support the work of groups. One common example of GDSSs is the Decision Conferencing (DC), which combines the use of decision analytic softwares to incorporate the differing perspectives of the participants with group facilitation techniques.

This thesis systematically reviews the existing case, field, and laboratory decision room type GDSS studies. It, then, explores the plausible factors for the inconsistent findings across studies. Main objective of the thesis, however, is to investigate the effectiveness of a DC in aiding group work with regard to decision processes, overall user attitudes, and decision quality, and to identify variables associated with differences in perceived effectiveness. Three theories were employed to build a conceptual framework with criteria by which to describe and evaluate the effectiveness of decision making in GDSS settings: Competing Values Approach, Stratified Systems Theory, and Human Information Processing Model. It was shown that these three approaches share common theoretical assumptions. Then, quantitative data were collected through a mailed questionnaire of participants in 22 conferences, hosted by the Decision Conferences Inc. in the U.S.A., Decision Analysis Unit at London School of Economics, and International Computers Ltd. in the U.K.

Overall, a DC was perceived better than a conventional meeting for all of the evaluation criteria. The effectiveness of a DC, however, was perceived differently according to various factors: participants' levels in the executive hierarchy, differences in the culture and style of the organisation, task differences in terms of the degree of threat, group size, variety of facilitators, and careers of the participants. Of greater interest is the finding that independent of the numerous variables above, a DC was perceived highly effective in terms of user attitudes, improved decision quality, adaptable process, goal-centred process, and efficiency of decision; and relatively less effective with regard to implementation, and accountability of decision.

**To the memory of my beloved father**

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## CHAPTER 1. INTRODUCTION

### 1.1. Introduction

Group decision making is probably one of the most important forms of organisational activity. Research suggests that a typical chief executive officer attends an average of 8 meetings in a single day (Mintzberg, 1973); middle level managers] spend as much as 80 per cent of their time in some form of grouplike conversation (Burns, 1984); \$290 billion was spent by US business managers on meetings in 1981 (Portway, 1985). Almost all important organisational decisions are arrived at as a result of group activity. Tropman (1980) observes " the modern committee is the center of decision making activity. Almost nothing is done, no decision made, no breakthrough accomplished, unless it is passed upon or actually created by one or more boards or committees. This is true whether within the organization or in the midst of the interorganizational network." Also, Edwards (1982, p.317) points out " in any decision situation, someone must sign off on the decision. ....But, the decision maker does not think alone, does not act alone, and does not maximize personal utilities - at least for significant decisions. Most important decisions are made by some form of committee."

### 1.2. The Positive and Negative Sides in Group Decision Making

Group decision making is, however, like a double-edged sword (Schermerhorn et al., 1985, p.270). It can have positive and negative effects on both organisations and its members. An understanding of the positive and negative aspects of group decision making can help to enhance the desirable consequences and reduce the undesirable consequences of groups as human resources of organisations.

#### 1.2.1. The benefits of group decision making

Follows are the lists of potential benefits of group decision making obtained from the relevant literature (Ackoff, 1981; Maier, 1967; Nutt, 1989; VanGundy, 1984).

##### 1. Greater sum total knowledge and information

The increasingly complex and turbulent business environments of these days require specialised domain knowledge pertaining to the issues which are usually beyond that of the most knowledgeable person. The involvement of more than one person

increases the information that can be brought to bear on the issues. This integration and sharing of knowledge is a major benefit to business groups.

#### 2. Greater number of approaches to the problem

The availability of several individuals means that more perspectives will be offered on a problem and the "tunnel vision" of a single perspective avoided.

#### 3. Better understanding of final decision

Because participants in group decision making are involved in all stages of discussion, comprehension of the decision is high.

#### 4. Increased acceptance of final decision

Participants in group decision making are more inclined to accept the final decision or feel a sense of responsibility for making it work.

#### 5. Reinforced cultural norms

Group decision making serves organisational coordination needs by facilitating the process of communication. More importantly, they help to reinforce cultural norms within the organisation and contribute to group cohesiveness.

A group decision making, however, is looked upon by many managers as a necessary evil (Byrne, 1987). Many participants come away from meetings believing that very little was accomplished. Managers are beginning to resist attending meetings because they take time away from other critical activities. In spite of their frequent use, groups and meetings are often regarded with dislike, if not outright contempt.

### **1.2.2. The problems of group decision making**

Research has identified a number of factors inhibiting group performance (Huber, 1984; Janis, 1972; Kirkpatrick, 1987; Maier, 1967; Nutt, 1976; Van de Ven & Delbecq 1974).

#### 1. A diffusion of responsibility and group induced shift

Research (Blascovich, 1976; Kerr, 1975) shows that when individuals discover in group discussions that their opinions are shared by others they may feel more strongly about their opinion and take a more extreme view. For example, Wallach et al. (1962) and Stoner (1968) report that member attitudes are consistently moving toward a more risky solution. Cartwright (1971), then, has shown that group induced shift is not always toward a more risky solution and that it is just as likely to be toward a more conservative view. Some research (Latane et al., 1978; Wallach et al. 1964) explains the shift of group opinions as due to a diffusion of responsibility (also known as Social loafing or Ringelmann effect). Members may feel, because the group is making the

decision, they are not individually responsible for the decision. A diffusion of responsibility may enable members to accept and support a more radical decision than they would make individually. A diffusion of responsibility also tends to cause people not to work as hard in groups as they would individually. This is because their contribution is less noticeable and because they like to see others carry the work load.

2. Groupthink or pressures toward conformity and implied threat of sanctions from the leader

In a highly cohesive group, with a high degree of member similarity and attractiveness to remain in the group, members sometimes strive for unanimity. Janis (1972; 1977) observed that group outputs are often highly dependent upon needs to have warm feelings of solidarity and consensus. This may cause a deterioration of thinking and judgement among group members. Its consequential defective decision making includes (1) inhibition of free expression of ideas, (2) incomplete survey of objectives and alternatives, (3) failure to examine risks of preferred choice, (4) poor information search, (5) selective bias in processing information at hand, (6) failure to appraise alternatives, and (7) failure to work out contingency plans. Consequently, the group makes a decision for which individual decision makers do not want to take the responsibility or that does not represent the true feelings of the members.

3. Escalation of commitment to a decision (Bazerman et al., 1984; Staw, 1981)

Staw found that when managers receive negative feedback about an investment decision, they allocate additional funds to the investment if they were responsible for making the initial investment.

4. Dominance of discussion by one or more members (Tjosvold & Field, 1983)

A dominant individual may emerge and control the group's decisions.

5. Status incongruities (Bridges, 1968)

There is a tendency of the lack of acknowledgement of the ideas of low status members. Also, low-status members usually defer to high-status members.

6. Lengthiness

Managers see groups as taking too much of their time. Groups are frequently slower to reach decisions than are individuals acting alone; groups can also delay decisions while individual members "play games" and/or "fight" with one another. So, group decision making can be costly.

7. Miscommunication among members is common.

8. Insufficient time is spent in problem exploration and generation of alternatives.

There is a tendency to reach speedy decisions before all problem dimensions has been considered (Van de Ven & Delbecq, 1974).

9. Undue attention to social activities relative to the task activities of the group

10. Low tolerance of minority or controversial opinions

### 11. Focus effects

Interacting groups fall into a rut and pursue a single train of thought for long periods (Van de Ven & Delbecq, 1974).

### 12. Conflict

A common obstacle to effective group decision making is conflict, especially in the expression of divergent points of view by group members (Cook & Hammond, 1982).

In addition to these interpersonal factors, a group decision making is also negatively affected by interfering environmental factors, and ineffective group facilitations.

## **1.3. Group Intervention Techniques**

The goal of a group decision making is to take advantage of the group as a decision resource while minimising its potential disadvantages mentioned above. Over the years social scientists have studied ways in which to avoid some of the liabilities of open group meetings as a basis for decision making and thereby take better advantage of groups as human resources of organisations. So, over 70 different problem solving techniques have been offered for use in groups (VanGundy, 1981). These group intervention techniques simultaneously attempt to enhance the level of participation among group members, to increase the quality and quantity of ideas generated, to promote cooperation among participants, and to prevent domination of the group by specific members. That is to optimise the resources of the group, and to achieve creativity in decision making by maximising group process gains and minimising group process losses (Eils & John, 1980; Schermerhorn et al., 1985).

Interventions to improve group decision making can be classified as being of two types on the basis of their primary target: the action of, or input to group decision making (Guzzo, 1982).

### **1.3.1. The action-oriented group decision making interventions**

Those techniques have as their target direct changes in the behaviour of decision making group members. These changes could be brought about by the creation of new patterns of social interaction, or by the establishment of specific procedures of task accomplishment. For example, they may require groups to adhere to a sequence of steps such as defining the problem, generating alternatives, and then evaluating and choosing among alternatives. Thus, such interventions can affect either or both the

social-psychological influences residing in a group and the processes of manipulating and utilising information.

The action-oriented interventions can be further classified as either in interpersonal- (designed mainly to improve the quality of group members' relationships) or procedure-oriented (providing specific strategies for more effective task performance) (Eils & John, 1980; Hackman & Morris, 1975). It is, however, apparent that both types of interventions shape the form and nature of information used in group decision making, as well as the overt behaviours of group members. The point is that whereas the former mainly concerns interpersonal behaviours among group members, the latter mostly concerns the sequencing and explicitness of certain information processing steps necessary for decision making.

### **(1) Interpersonal-oriented interventions**

Several distinct programmes of research have attempted to tackle the interpersonal problems inherent in group decision making. Here, two popular techniques amongst others are briefly introduced: Communication instruction (Hall & Watson, 1970) and Social Judgement Analysis (SJA) (Brehmer, 1976; Hammond et al., 1986).

#### **(i) Communication instruction**

One of the well known interpersonal-oriented interventions is a communication instruction (Hall & Watson, 1970). It is simply a set of verbal instructions to the group members about how to discuss and resolve differences optimally. It is essentially concerned with communication process in groups, and is designed to achieve consensus through altering the interpersonal behaviour of group members. Follows are brief guidelines suggested by Hall and Watson (1970) to use in achieving consensus: (1) avoid arguing, (2) avoid "win-lose" statements, (3) avoid changing their opinions only in order to avoid conflict and to reach agreement and harmony, (4) avoid conflict-reducing techniques such as the majority vote, averaging, bargaining, coin flipping, (5) view differences of opinion as both natural and helpful rather than a hindrance in decision making, and (6) view initial agreement as suspect. The literature described in Eils and John (1980) (such as Hall & Watson, 1970; Hall & Williams, 1970; Nemiroff & King, 1975; Nemiroff et al., 1976) yield strong empirical evidence supporting the communication instruction approach to interpersonal problems. For example, Hall and Watson (1970) found significant increments in communication instruction groups' performance in terms of group error score and

gain over the average group member's response. Nemiroff et al. (1976) compared the communication instruction to both the Nominal Group Technique (NGT) and a control group. They found that the communication instruction groups significantly outperformed the other two groups in terms of absolute error score, as well as in gain over the average group member's error score. No differences were obtained between the NGT and conventional process groups. A communication instruction established new behaviours for handling conflict in groups and the manner of presenting individuals' points of view, and produced considerable increments in performance.

## **(ii) Social Judgement Analysis (SJA)**

Another popular example of interpersonal-oriented interventions is a Social Judgement Analysis (SJA). Social judgement theory was initially concerned with studying the cognitive characteristics of conflict situations (Hammond et al., 1975). It posits that individuals disagree in judgement at least in part because of the importance that each differentially assigns to the available information and because of the various manners in which each functionally relates the data to his final judgement (Rohrbaugh, 1981). Hammond and Brehmer (1973) have suggested that information about differences in judgement policies of each participant ( i.e., "cognitive feedback") should reduce disagreement and improve the quality of judgement more effectively than outcome feedback. Thus, instead of individuals' trying to deal blindly with differences in the outcomes of their overt judgements alone, they are permitted to explore in depth the differences in the logic of their underlying judgement policies (Rohrbaugh, 1979). Within the procedure, individuals are presented with choice alternatives for evaluation. After making private evaluations, individual judgements are made public to all group members. The group is then required to reach a consensus judgement via free discussion. By programming the technique for interactive use with a computer, various descriptive statistics inferred from the individual and group judgements can also be used as cognitive feedback. Early laboratory research supported the suggested superiority of cognitive feedback to outcome feedback in improving the accuracy of individual judgement and reducing disagreement within dyads (Hammond et al., 1975). Rohrbaugh (1979; 1981) compares the NGT, Delphi, and SJA methods in controlled experimental settings with regard to their potential both to significantly reduce group disagreement and to provide accurate judgements. The three methods altogether were found to be equally strong in the quality of judgements produced. SJA, however, was found to be a significantly better method of developing consensus among group members than the NGT or Delphi methods.



## **(2) Procedure-oriented interventions**

Maier (1963; 1970) may be an early proponent of the utility of the procedure-oriented interventions. He suggests the forced separation of idea generation from idea evaluation. Separating idea generation from evaluation is beneficial to group decision making because it forces a group to examine extensively the nature of the problem, promotes the appearance of many possible solutions for a group's consideration, and decreases the tendency of groups to be "solution-minded", that is, to rush toward the adoption of a solution (Guzzo, 1982). Similarly, Hackman and Kaplan (1974) found that successful groups tend to devote adequate time to problem formulation and planning of meeting process, whereas unsuccessful groups tend to immediately begin to search for alternative solutions. The rationale for procedure-oriented interventions is the "rational decision making approach", which is by far the predominant view of how decisions ought to be made. Although there are a number of the different types of this approach, Mintzberg et al. (1976) well summarised them in terms of a number of distinct steps or stages:

(1) recognition. The environment is constantly surveyed for new opportunities using many different kinds of information, financial, industry reports and the like, or informal information. The essential idea is of decision makers who are constantly alert to opportunities.

(2) diagnosis. The problem is defined in terms of the decision makers' objectives.

(3) search. Information is sought concerning possible solutions.

(4) design. Possible solutions are created to solve the problem.

(5) evaluation. Each solution is thoroughly assessed.

(6) choice. The optimal solution is selected according to objectives.

(7) authorisation. In an organisation the choice usually needs to be authorised at a higher level to ensure coordination with the overall organisational objectives

(8) implementation. Since the optimal choice has been selected implementation will follow.

Popular approaches to procedure-oriented interventions for improving group decision making are, amongst others, the Nominal Group Technique (NGT), Delphi Method, and Multi Attribute Utility Analysis (MAUA).

### **(i) Nominal Group Technique (NGT) and Delphi method**

Both NGT and Delphi are used to reduce anticipated problems with group interaction processes. NGT (Delbecq et al., 1975; Van de Ven & Delbecq, 1971; 1974) was

developed by Delbecq and Van de Ven in 1968. It was designed to systematise group discussion by introducing stages or steps to sequence interaction, each having a unique format suited for the work of the group during the period. It derives its name from the fact that it severely restricts the amount of free, face-to-face interaction that we typically think of when referring to a group. Thus, to some degree, individuals adopting this technique are a group in name only. By imposing a precise structure upon an interacting group, NGT is intended to reduce process losses (e.g., the domination of discussion by one or two members, the tendency for groups to pursue digressive ideas for extended periods, or the social pressure placed on dissenting minorities to conform to group norms). So, it could be more appropriate than an open meeting in situations where group members have differing opinions and goals so that antagonistic argument can be predicted. The 6-step process of decision making in NGT includes the following steps: (1) silent generation of written ideas by group members alone; (2) round-robin feedback from group members to record each idea in a terse phrase on a flip chart; and (3) discussion of each recorded idea individually in round-robin sequence for purpose of clarification only; evaluative comments are not allowed. Then, judgement is used as follows: (4) individual written voting on priority ideas through rank-ordering or rating by secret ballot; (5) brief discussion of the preliminary vote; and (6) final individual voting through rank-ordering or rating by secret ballot with the group decision being mathematically derived (Rohrbaugh, 1981; Schermerhorn et al., 1985).

The Delphi Method (Linstone & Turoff, 1975) was developed by Rand Corporation over the past 40 years in an effort to improve the accuracy of forecasting technological change. The Delphi procedure involves a series of questionnaires distributed over time to a decision-making panel. A typical approach works as follows: The first questionnaire states the problem and requests potential solutions. These solutions are summarised by the decision coordinator. The summary is returned to the panel in a second questionnaire. Panel members respond again, and the process is repeated until a consensus is reached and a clear decision emerges. Developers of Delphi were so concerned about the negative consequences of face-to-face meetings that the method eliminated interaction processes altogether, instead, providing a series of opportunities for each group member to make anonymous judgements and to learn about others' assessments with statistical feedback summarising collective performance (Linstone & Turoff, 1975).

However, subsequent studies (e.g., Gustafson et al., 1973; Kaplan et al., 1950; Nemiroff et al., 1976; Van de Ven & Delbecq, 1974) have provided contradictory

evidence about the usefulness of NGT and Delphi. In particular, Rohrbaugh (1979; 1981) found that such interventions external to the group may produce unintended consequences: although no significant differences in the accuracy of the final products of the groups emerged, both NGT and Delphi techniques appeared to be significantly less helpful in facilitating individual learning, in reducing intragroup conflict, and in building consensus than circumstances in which individual cognitive feedback was provided to each member, freely exchanged, and fully discussed.

## **(ii) Multi-Attribute Utility Analysis (MAUA)**

MAUA is a recent extension of modern utility theory as it developed from the landmark work of von Neumann and Morgenstern (1944) (for good reviews of MAUA, see Fishburn, 1977; Keeney & Raiffa, 1976; von Winterfeldt & Edwards, 1986). It extends the applicability of the decision tree approach to allow judgements involving multiple criteria and conflicting points of view. It provides a decomposed evaluation procedures as a means of improving upon the intuitive decision-making process. Decomposition methods divide the complex overall evaluation task into a set of simpler (manageable) subtasks, each of which is within the judgemental capacities of the decision makers. This divide and conquer approach of MAUA procedures require groups to follow the 5 steps (von Winterfeldt & Edwards, 1986):

- (1) define alternatives and value-relevant attributes
- (2) evaluate each alternative separately on each attribute
- (3) assign relative weights to the attributes
- (4) aggregate the weights of attributes and the single-attribute evaluations of alternatives to obtain an overall evaluation of alternatives
- (5) perform sensitivity analyses and make recommendations.

A number of research provides strong evidence for the argument by Edwards (1977) in support of decomposed methods of evaluating complex choice tasks. For example, Gardiner and Edwards (1975) found that less disagreement among two groups of land management planners (conservationists and developers) occurred when a highly structured MAU procedure was employed to determine preference than when simple holistic (unaided, intuitive) judgements were elicited from the group. Eils and John (1980) compared the SMART (simple multiattribute rating technique) to both the Hall and Watson's communication instruction and a control group. They reported that the use of the group decision aid of SMART significantly improved the quality of collective decisions, as did, to a lesser extent, the communication instruction. Weiss and Zwahlen (1982) also reported that the use of a formal quantitative decision-

analytic procedure of building a MAU model helps the group to define the options and their impacts more clearly and logically, thereby improving the quality of communication. In addition, by forcing the group to provide unambiguous, consistent trade-off judgements, the process helps the group to make difficult judgements in a systematic and justifiable manner, and permits incorporation of individual values (utilities) into the selection of alternative courses of action. It also helps identify major discrepancies among the different group members' viewpoints, irregularities which, upon detection and special consideration, were resolved quickly by the group's discussion. So, it enhanced agreement among group members.

### **1.3.2. The input-oriented interventions**

Input-oriented interventions also seek to change behaviour in groups, but they attempt to do this indirectly rather than directly (Guzzo, 1982). Inputs to group decision may include the distribution of abilities and vested interests among group members, the nature of available information, group size, the reward structure under which a group exists, time pressures for decision making, working environment, various IS technology, or meeting facilitator. Thus, it is possible to intervene to arrange inputs and circumstances such that effective decision making will be more likely, without explicitly specifying new patterns of behaviour for group members.

One of the examples of this type of intervention is the attempt to increase the general behavioural and social skills of individuals through training, which an individual carries into a group setting. Hall and Williams (1970) investigated the effects of laboratory training in group dynamics on the performance of decision-making groups. They found that such training was in fact related to increased performance in decision-making groups. Other example may be the establishment of working environment. The environment in which the group works can have a critical influence on how the group functions (Eden, 1990b; Hickling 1990). Phillips and Phillips (1991) conclude that when a room is untidy and ill-arranged, and no limits are imposed on participant observers, breaks, or start and stop times, groups may find it difficult to attend to the task at hand. When the environment and the arrangements for using it are focused, the group focuses more readily. Input-oriented interventions can also use various technologies for the processing of information. For example, public display screens put information that was already potentially available to all in a new, organised format, enabling group members to pinpoint areas of agreement and disagreement and thus facilitating the movement toward a decision. Although Guzzo (1982) thought that input-oriented interventions attempt to change behaviour in

groups indirectly rather than directly, some technologies (e.g., electronic communication channels) can change group behaviour directly. As with action-oriented interventions, the consequences of input-oriented interventions can affect information processing and social-psychological factors in a group.

#### **1.4. A GDSS as the Integration of an Action-, and Input-Oriented Intervention**

VanGundy (1981) points out that these group management techniques, however, have not become very popular in organisations for enhancing day-to-day group processes. Among the reasons for this could be (1) the techniques are too cumbersome, (2) the necessary expertise is lacking, (3) they are too time consuming, (4) they are expensive to conduct, and (5) they require frequent re-learning on the part of group members.

With recent advances in computer, telecommunication and management science techniques, serious efforts have been made to use technology to counter the negative effects of group intervention techniques and to enhance group performance. An example of such attempts is the development of Group Decision Support Systems (GDSSs). Guzzo (1982) argues that two types of interventions (action-, and input-oriented) can be, and often are, made simultaneously. Many of GDSSs seek to address the concerns related to the interactions of the group as well as hardware and software concerns. In other words, GDSSs attempt to aid a group decision making using the two types of interventions simultaneously. Sutherland and Crosslin (1989) pointed out the importance of the combination of two approaches in group decision-making: the process (that, action-oriented intervention) by which a group arrives at decisions, with the technology involved (that, input-oriented intervention), can have a significant impact on the final outcome and on the group members' satisfaction with the decision. In GDSSs, the technology (an input-oriented intervention) should allow the structure (an action-oriented intervention) to be invoked and applied more quickly than is possible with an action-oriented intervention only. For example, Huber (1982) suggested that there are some negative features such as time and information losses associated with using group intervention techniques and that information technology could be used to counter this effect. Huber (1982) and Wagner (1982), then, pointed out that the NGT could be cumbersome when applied manually. They described how GDSSs could be used to support the NGT. Another example is a Decision Conferencing. The MAU model (that, an action-oriented intervention) used in a Decision Conferencing incorporates the differing perspectives of the participants in the group. It lends structure to thinking, and allows all perspectives on a problem to be represented and discussed (Phillips, 1984a). Facilitators and computers (that, an

input-oriented intervention) can assist to examine the overall set of judgement in the model, their implications, and the possible impacts of altering certain key assumptions, thereby ruling out ineffective strategies and focusing quickly on primary issues of major impact. They facilitate rigorous analysis of available evidence. Therefore, the MAU model (an action-oriented intervention), and facilitators computers (that, an input-oriented intervention) together help participants to develop a shared understanding of the problem and to reach agreement about what to do.

## 1.5. Implications

Most of existing GDSSs tend to take a shape of the combination of procedure- and input-oriented intervention. SAMM and DECAID of the University of Minnesota basically incorporate a rational problem-solving agenda. Plexsys of the University of Arizona is composed of various softwares to support specific group activities inherent in each decision making phase (e.g., Session initialiser, Electronic brainstorming, Issue analysis, Policy formation, or Voting). Decision Conferencing employs MAU model (HIVIEW, EQUITY) which also require participants to follow specific steps in decision making. However, no GDSSs have been found to combine two types of action-oriented interventions (interpersonal- and procedure-oriented) simultaneously with input-oriented interventions (computer and other IS technology). In their GDSS experiment, Loy et al. (1987) point out that the structure of the group processes and interpersonal communication affect the quality of problem structuring and, therefore, the quality of group problem understanding and decision performance. So, GDSSs must pay attention to the importance of interpersonal- as well as procedure-oriented interventions.

We saw before that Hall & Watson (1970) communication instruction (an interpersonal-oriented intervention) establishes new behaviours for handling conflict in groups and the manner of presenting individuals' points of view, and produces considerable increments in performance. We also saw that the use of a group decision aid of MAUA (a procedure-oriented intervention) significantly improves the quality of collective decisions and lessens disagreement among members. Eils & John (1980) argue that there is a need for further development of the communication instruction for use in concert with analytic decision technologies. One of the implications of these studies for GDSSs is that it may be worthwhile to develop and test interpersonal-, procedure- and input-oriented techniques in concert with one another. For example, a facilitator in Decision Conferencings may apply Hall & Watson(1970) communication instruction to existing Decision Conferencing method.

Better understanding of the destructive nature of group interaction also allows us to build a more formalised, theory-based and demand-pull rather than supply-push rationale for GDSS development. Thus, we can develop design strategies that encounter negative characteristics of group decision making while enhancing the positive ones. Although 12 items of negative factors in group decision making mentioned earlier allow us to some extent to understand the negative aspect of group interaction, one relevant study summarised below might be useful in GDSS development. As we saw earlier, most of existing GDSS softwares impose a certain step in decision making process. Schwenk (1984) summarises heuristics and biases inherent in each decision making phase. So, his phase-associated heuristic list might be useful for GDSS developers or facilitators. He categorises a decision making process into 3 phases: goal formulation/problem identification stage, alternative generation stage, and evaluation and selection stage. He, then, identifies 4 common heuristics and biases in each decision making stage.

#### I. Goal formulation/Problem identification stage

##### (1) Prior hypothesis bias

Decision makers with this bias tend to ignore or misinterpret information. They overestimate the value of information which confirms their hypotheses and undervalue disconfirming information. Under the influence of this bias, decision makers who believe that the company's current strategy is successful may ignore information suggesting gaps between performance and expectation.

##### (2) Adjustment and Anchoring

Under the influence of this bias, decision makers tend to deny gaps between performance and expectation. So, their revisions may be smaller than are justified by the new information. Final estimates of values are usually biased toward the initial judgements: the adjustments are typically insufficient.

##### (3) Escalating commitment

If the gap between performance and expectation is recognised, decision makers may deny its significance. That is, they may define the problem indicated by the gap as a minor one which does not require a change in strategy. The feeling of personal responsibility for the project apparently induces decision makers to remain with their chosen project in spite of evidence that it is not paying off. People may explain a perceived discrepancy as a result of chance factors rather than a result of a flaw in initial strategy. If they adopt this interpretation, they are likely to persist in the current course of action and escalate commitment to it.

##### (4) Reasoning by analogy

This bias involves the application of simple analogies and images to guide problem definition. It may help to reduce the uncertainty perceived in the environment. But decision makers may not objectively evaluate the extent to which their analogy is representative of their decision situation.

## II. Alternative Generation

### (1) Single outcome calculation

Decision makers may focus on a single one of their goals or values and a single alternative course of action for achieving it. Here, uncertainty is often not resolved by probabilistic calculations of the outcomes of alternatives. Rather, favourable outcomes are inferred for preferred alternatives whereas unfavourable outcomes are projected for non-preferred alternatives.

### (2) Inferences of impossibility

Decision makers may devote a great deal of effort to identifying the negative aspects of non-preferred alternatives and attempting to convince themselves that they are not possible to implement. Since, this forces premature rejection of alternatives, it may lead to a premature closure at the possible cost of rejecting the most feasible alternatives.

### (3) Denying value trade-offs

Decision makers may interpret facts in such a way that the favoured alternative appears to serve several values simultaneously and appears to have little costs associated with it. They attempt to deny that there are trade-offs and that there are some values which may not be served by their favoured alternative.

### (4) Problem set

Strong commitment to a set of assumptions about the nature of business and appropriate solutions to its problems is a persistent problem in corporate strategy formulation.

## III. Evaluation and Selection

### (1) Representativeness

It causes a decision maker to overestimate the extent to which a situation or sample is representative of the situation or population to which he wishes to generalise. To overestimate the past is representative of the present and solutions offered for problems in the past will be of value in the present problem.

### (2) Illusion of validity: overconfidence in forecasts



Decision makers tend to be overly confident in their ability to predict outcomes which may perpetuate the illusion that their predictions are valid.

### (3) Illusion of control

People making a variety of decisions tend to express an expectancy of personal success higher than the objective probability would warrant. They tend to overestimate their skill or the impact it would have on the outcome.

### (4) Devaluation of partially described alternatives

Preference for complete information may affect decision makers' evaluation of alternatives. Decision makers tend to devalue the alternative that is partially described. Since partially described alternatives involve uncertainty for decision makers, they tend to negatively evaluate these against alternatives which are better described and, therefore, resolve more uncertainties.

In their extensive review of research on decision making, Abelson & Levi (1985) point out that there is a very little research on the problem formulation phase of decision making, perhaps it is often taken for granted. As Huber (1984) indicated, most existing GDSSs also provide support only for the alternative generation and evaluation/choice phases of decision making. However, problem formulation is the most important stage of the whole decision making cycle (Schein, 1988). An incorrect diagnosis of the problem inevitably dampens the subsequent phases of decision making, therefore lead to wrong decisions. So, problem formulation aids are essential for decision support. But, Schein (1988) asserts that defining the problem is the most difficult stage in problem solving processes partly because of a confusion between *symptoms* and the *problem*. He, then, suggests a procedure-oriented intervention for this stage (Schein, 1988, vol.1, p.64):

Feelings of frustration --> and tension	Identification of specific incidents --> which arouse feelings	Analysis of --> incidents	Generalisation from incidents --> concerning the nature of the problem	Problem formulation
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The essential step is to examine the concrete incidents (symptoms) and then determine what those incidents have in common. This method can also be used by the facilitator in GDSSs.

## **1.6. Objectives of thesis**

The growing popularity of a GDSS has been supported by, and has given rise to, a burgeoning academic literature on GDSSs since the mid-1980s. However, research dealing with GDSSs is still in the laboratory stage (Gray & Nunamaker, 1989). Although there is growing body of laboratory experiment findings, the results are still inconclusive. Field studies in real organisation settings are all the more scarce. Only some anecdotal evidence are reported. Now that more group cooperative supports become more widespread, field studies in real world settings are needed in order to achieve a more comprehensive understanding of the implications for organisations of the adoption of GDSSs.

Current study provides us with the rare observations of the effectiveness of one type of GDSSs (here, a Decision Conferencing) in real world settings. The primary purpose of the study is to investigate the effectiveness of a Decision Conferencing in aiding group decisional activities with regard to decision processes, overall attitudes, and decision quality through the use of a mailed survey of conference participants, and to identify variables associated with differences in perceived level of conference effectiveness. To do that, a total of 22 conferences were selected for follow-up study: 5 hosted by International Computer Limited, 12 by Decision Analysis Unit at LSE in the UK, and 5 by Decision Conferences, Inc. in Colorado, USA (see chapter 5). However, such field study means that we will have less control over contextual and independent variables than in laboratory settings. Therefore, I have to admit that the results of current study leaves open many alternative explanations. At best, this study may develop the contingency perspectives with regard to the use of one type of GDSSs in real world settings. But, it is hoped that the contingency perspectives obtained from this study can be used as a starting point for us to develop progressively GDSSs that better meet the needs of users in organisations. This study is directed towards that end.

## **1.7. Organisation of thesis**

A fundamental question addressed by this thesis is: can GDSSs be able to improve both the efficiency and the effectiveness of organisational group decision making processes, and at the same time, to enhance user satisfaction? To address this question, the thesis is organised as follows.

Chapter two investigates existing empirical research on the impacts of decision room type GDSSs. It shows how the name and the goal of a GDSS has been changed since the early 1980s. Then, it systematically reviews previous case, field, and laboratory experimental GDSS studies.

Chapter three explores the plausible reasons for the inconsistent findings across the laboratory studies, and especially between field and laboratory research. It suggests five main factors for the inconsistent findings in previous GDSS research: contextual pressures, tasks, group characteristics, technical configurations, and comparability of measures. Here, the importance of multidirectionally interacting relationships between these factors are emphasised.

Chapter four sets out and develops a theoretical framework for describing and evaluating the effectiveness of decision making with GDSSs. Three theories from which the questionnaire has been developed are introduced: Competing Values Approach, Stratified Systems Theory, and Human Problem-solving Style Model. Further, these three approaches are argued to share common theoretical assumptions.

Chapter five explains the method of the test. It also describes main variables used for the test. Chapter six shows the results of the analysis. Finally, chapter seven summarises the conclusions which our analysis has led us to, and in the light of these, outlines the implications they have for theory and practice.

## CHAPTER 2. GDSS LITERATURE REVIEW

This chapter is to review and analyse the available empirical research on the impacts of one type of computer based technology used to support group processes: decision room (DeSanctis & Gallupe, 1985) or war room (Widener, 1981). Obviously, there is a much broader scope to GDSS research (i.e., Siegel et al., 1986; Turoff & Hiltz, 1982). A taxonomy of GDSSs is well provided elsewhere (see Dennis et al., 1988; DeSanctis & Gallupe, 1987; Huber, 1984; Kraemer & King, 1988). However, I focus my attention on face-to-face meeting processes, since as Wagner and Nagasundaram (1988) pointed out, these will continue to remain the most important form of group activity.

The chapter begins with a brief description of how the goal of a GDSS has evolved since the early 1980s. This is followed by a review of previous case and field studies as well as laboratory experimental tests.

### 2.1. Introduction

Since the late 1970's, when Dr. Cameron Peterson of Decisions and Designs, Inc. invented a Decision Conferencing, and Execucom Corporation built their Planning Lab (Gibson & Ludl, 1988; Kull, 1982; Phillips, 1989b; Wagner 1982), there has been a growing attention from researchers and practitioners to the development of computer-based systems to support group cooperative work. A brief chronology of the systems is provided elsewhere (see Gray & Nunamaker, 1989). However, there is little agreement in the literature or among people working in this field about what constitutes a group decision support system (Kraemer & King, 1988). Just reflecting the disagreement, researchers name it differently from each other: Cooperative Group Decision Support Systems (Bui & Jarke, 1984), Group Deliberation Support Systems (Gray, 1986), Groupware (Richman, 1987), Electronic Meeting Support Systems (Dennis et al., 1988), Computer-Supported Cooperative Work (Greif, 1988), Computer-based Meeting Support Technologies (Jarvenpaa et al., 1988), Group Communication Support Systems and Group Decision Support Systems (Pinsonneault & Kraemer, 1989), Group Support Systems (Vogel et al., 1988), Group Process Support Systems (Wagner & Nagasundaram, 1988), and etc. This variety of terms clearly reflects the differences of researchers in their beliefs about what a GDSS is and, therefore, how it should be designed (The main differences in system configurations between institutions will be discussed in detail at chapter 3.4). It also

shows that the technology expands in scope to assist groups in a wide range of cooperative works, not just decision making. However, recent articles again tend to use the term GDSSs to imply the general class of systems, which can be talked about in general (Eden & Radford, 1990; Gray & Nunamaker, 1989; George, 1989). Definitions of a GDSS also change from more technology-specific to more general. Huber (1984), for example, offers "a GDSS consists of a set of software, hardware, and language components and procedures that support a group of people engaged in a decision-related meeting." Now, it is generally accepted that any application of information technology to support the work of groups may be considered a GDSS. But, Phillips (1990) points out that the possible differences between GDSS researchers in their notion of work, and how that work is best supported, allow them to develop very different approaches each other.

## **2.2. Performance versus Satisfaction**

Keen and Morton (1978) addressed that ideally the goal of a DSS should be to enhance user satisfaction and confidence, as well as to improve decision quality. Even if many GDSS researchers, since then, have addressed the definition of a GDSS so variously, the ultimate goal of a GDSS still remains same as Keen and Morton's: to achieve seemingly conflicting goals of performance (improving decision quality and reducing meeting time) and satisfaction (reducing conflict, satisfying with process and outcome, and gaining consensus) at the same time. DeSanctis and Gallupe (1987) argue that the most difficult issue that researchers and organisations must address with regard to GDSSs is the desired balance between decision quality and satisfaction with the group process. In reality, quality is often sacrificed to gain acceptance and vice versa. Hoffman and Maier (1961) show that acceptance of a group's solution frequently has a low correlation with the objective quality of the solution generated. DeSanctis and Gallupe (1987) go further that GDSSs cannot be expected to resolve this problem; if anything, the issue may become more poignant in the case of a GDSS. Turoff and Hiltz (1982) also argue that high satisfaction and high decision quality cannot be simultaneously achieved in computer-mediated meeting environments, due to the novelty of the technology and the possibility of greater perceived conflict and depersonalisation. In fact, some experimental GDSS studies (Gallupe, 1986; Gallupe et al., 1988; Watson et al., 1988) support this view: improved decision quality, but increased conflict and less satisfaction with the process. Jarvenpaa et al. (1988) reported the insignificant effects of the technology on satisfaction, but positive effects on the quality of team performance. Reversely, Zigurs et al. (1988) found from their

laboratory study that a GDSS resulted in a illusory benefit (positive user affect without corresponding improvements in decision quality).

However, other experimental GDSS studies (Jessup et al., 1988; Lewis, 1982; Steeb & Johnston, 1981) and most field studies (Adelman, 1984; Dennis et al., 1990; Gray, 1983; Nunamaker et al., 1987;1988;1989; Phillips, 1985;1986; Vogel et al., 1987; Vogel & Nunamaker, 1988;1990; Volpato, 1989; Weiss & Zwahlen, 1982) report that GDSS use improves decision quality and increases user satisfaction with the process and outcome at the same time.

### **2.3. Evolution of the Goal of a GDSS: from Performance-Oriented to Satisfaction-Oriented**

Reviewing the GDSS literature, we can find a steady, but interesting evolution of the researchers' emphasis on the aspect of a GDSS: from more performance-oriented to more satisfaction-oriented.

In the early stage of GDSS development, Gray et al. (1981) revealed that the goal of the system was to facilitate the integration of new group decision support technologies into the senior executive environment. GDSSs should (1) be suited for generation of promising alternatives while, (2) help focus some groups on promising alternatives while allowing the others to delete unpromising ones. Huber (1982; 1984) also suggested that two fundamental objectives of a GDSS were (1) to shorten meeting time by increasing meeting efficiency and effectiveness, and (2) to mitigate information loss and distortion which causes sub-optimal decision making. Kull (1982) expected the computer's assistance to both speed deliberations and enhance decisions. According to Kraemer and King (1986), the goal of a GDSS should be to provide timely, relevant, and accurate information to system users in order to enhance human judgement, and decision-making efficiency and effectiveness, concerning resource allocations that affect issues under consideration. DeSanctis and Gallupe (1987) also argued that GDSSs should aim to support both the social needs of groups as well as their task-focused activities. They, then, added that the long-term objective of a GDSS technology should be to improve the efficiency and effectiveness of group decision making. In short, those researchers' concerns were more related to the aspects of the system's productivity, efficiency and effectiveness in group decision making.

However, with the careful introduction of the system to the real world, GDSS researchers have gradually emphasised the importance of users' "feelings." Vogel et al.

(1987) argue that the ultimate goal of a GDSS is to improve decision quality and reduce meeting time in an atmosphere conducive to group member satisfaction. Gray (1987) develops his view that GDSSs are designed to help groups of senior management and professional groups reach consensus. Phillips (1986) asserts that the purposes of a GDSS (here, Decision Conferencing) are to generate a shared understanding of the issues and a commitment to action. Dennis et al. (1990) put that in the case of a GDSS, user attitudes have been recognised as critical to acceptance and adoption of the technology. Gallupe and McKeen (1990) also express that positive sentiments following use of a GDSS may be even more important in organisational settings where group meetings are used to gain consensus and acceptance of ideas, rather than to gain better ideas.

Why have researchers' views been changed from performance-oriented view in early 1980s to satisfaction-oriented one in recent years? GDSS studies had been begun from laboratory settings using groups of students formed solely to address an artificial task created for an experiment. The groups were merely created to conduct an experiment, not because they had the desire to solve a particular problem. So, they generally did not have their own group history and did not have ongoing interest in the task. More importantly, they did not need feel responsible for the implementation of their decision. What they were mostly concerned and required was the "correctness of answers to the given questions." In this circumstances, user satisfaction and consensus reaching could not be regarded as important variables as decision quality. It was also more "objective" for researchers to measure decision quality (e.g., by comparing subjects' number of comments with those of instructors) than to measure the degree of satisfaction or consensus. But, with the applying of a GDSS to the real world setting in recent years, GDSS researchers have realised that user perception with the use of a GDSS is sometimes more important than decision quality. Moreover, even if GDSSs are intended to help managers to solve their ill-structured problems, the nature of the ill-structured decision situations precludes knowing a "correct" solution. As Mason and Mitroff (1983) commented, for ill-structured problems there is no criterion to determine a solution correct or false: solutions are judged as good, bad, reasonable, but never correct or false. Watson et al. (1988) also argue that many organisational meetings occur without prior or post knowledge of the "correct" outcome of a group meeting. In such situations, groups must often resolve competing personal preferences and maximise agreement on a solution to a problem. In such situations, achieving high decision quality is not the primary goal of the group meeting. Vroom and Yetton (1973), Maier (1967), Janis and Mann (1977) and others have pointed out how decision making in organisational settings is often characterised

by a need to arrive at a mutually acceptable decision rather than an optimal one. Johnson (1974) also provides a nice example of this tendency to seek unanimity and avoid conflict in decision making. She hypothesised that executives would make a less desirable but acceptable short-run decision to avoid generating conflict with others in the group. Using 49 businessmen across ten situations she discovered that although subjects could identify the ideal decisions for each situation, their overwhelming tendency was to make suboptimal decisions in order to avoid conflict.

#### **2.4. Previous GDSS Research**

Previous research conducted at various institutions reveals that even within a decision room type GDSS, there are considerable variations across system configurations, and how they are used in particular experiments. Basic things, like software design and functionality, room configuration, method of facilitation, and group process technique, differ remarkably from one GDSS to the other. More important, perhaps, is the realisation that the developers of each GDSS have unique philosophy and vision about what a GDSS is and what it should do. For example, Phillips(1988) contrasts the "people-centred" GDSS with the "computer-centred" GDSS. The Xerox (Stefik et al., 1987) and the Arizona (Vogel et al., 1988) rooms are workbench environments in which people interact mainly via individual terminals (multiple workstations), whereas the Pods at LSE and ICL provide a problem-solving environment that gives easy access to a variety of media, including computers, in which computers and other media support the participants who interact directly with each other (a single workstation). Basic assumption in the design of the decision room even within the multiple workstation type GDSS is also different from each other. Claremont (formerly SMU room) room (Gray et al., 1981; Gray, 1989) is based on the assumption that most executives do not type or do not like to type. Therefore, the individual terminals are touch screens and are menu driven. However, Minnesota (Gallupe et al., 1988) and Arizona (Nunamaker et al., 1988) rooms are based on the different assumption that previous experience or skill of keyboarding has little to do with actual GDSS usage. While some GDSSs (e.g., Decision Conferencing) believe the importance of the facilitator, others (e.g., SAMM and DECAID of the University of Minnesota) do not.

The experiments designed to test the effects of a GDSS also differ from each other, along many dimensions. For example, to compare the results of using one software in one experiment, to those of using different software in a different experiment, can be misleading. While some research compares the effects of a GDSS to a manual



structured process(MS), others compare GDSS groups to baseline (no support at all: NS) groups. The comparison of NS to MS permits determination of simple structure effects; the comparison of MS to GDSS permits determination of "pure" computer system effects; and the comparison of NS to GDSS groups permits determination of effects due to support versus no support (Easton et al., 1989; Watson et al., 1988). So, comparing the results between studies without considering the differences between the phenomena being investigated with each research design can be difficult to interpret.

Given these differences, general statements about a GDSS also can be misleading, and it should hardly be surprising that findings from various GDSS research tell us different things. All of the findings across systems and across experiments must be interpreted carefully, because the findings are often the answers to different research questions (Dennis et al., 1989; Gallupe et al., 1988; George et al., 1989). Seventeen years ago, Hoffman (1975, p.386) cautions that extrapolating the results of current research to group decision making in organisational settings may be fraught with danger and the conclusions should be accepted with utmost caution. Now, this caution can be exactly applied to the current GDSS research.

However, contradictory results in current GDSS research also suggest the need for more exploration and comparison of how different technologies are used across a variety of circumstances, so that determining exactly what features of a GDSS provide the most effective and efficient support for specific types of circumstances (Gallupe et al., 1988; Jarvenpaa et al., 1988). Kraemer and King (1986) suggest that an examination of the experiences with GDSSs would provide valuable information about the promises, problems, and challenges involved in the technology. By examining the differences among previous studies, we are able to draw implications for the design of future studies (Dennis et al., 1989). Therefore, current study aims to build on previous decision room type GDSS research findings at this chapter, and to provide possible reasons for the inconsistencies in the results of existing studies at the next chapter. The focus is more on identifying and summarising the findings that have been researched rather than critiquing specific studies.

### 2.4.1. GDSS effects on performance

Many GDSS experiments have examined the effects of a GDSS versus no GDSS support (either manual structured process which has the same structure as the GDSS or no structured support at all) on user performance. Typical variables are the quality of group decision making and decision time, which are usually examined by comparing subjects' (mostly students) scorings with the experts'. This method, however, cannot be easily used to real world setting where users are the specialists in their organisation's business. No one can know it as well as they do. As we can see below, previous GDSS research shows somewhat conflicting picture with regard to the two performance criteria: decision quality and decision time. A summary of previous research with regard to these two criteria is provided at table II-1 (page 42), and II-2 (page 44).

#### (1) Experimental studies: decision quality

##### (i) GDSSs versus no support treatments

Six studies have shown that use of a GDSS improves a decision quality compared to no support at all treatment (Easton et al., 1989; Gallupe, 1986; George et al., 1988; Jarvenpaa et al., 1988; Jessup et al., 1988; Lewis, 1982). While one study (Easton, G., 1988) have shown the use of a GDSS to have no effect on the decision quality, the other study (Watson et al., 1988) report that decision quality of GDSS groups was lower than that of baseline groups, because users suffered from problems due to their lack of familiarity with the technology. They, then, conclude that the group's cognitive struggle and procedural orientation due to the unfamiliar technology may imply that chauffeurs will be necessary in GDSS settings, or repeated use of a GDSS will reduce these problems. In fact, two longitudinal studies (Sharda et al., 1988; Van Schaik & Sol, 1990) have shown that in earlier stages of the use of a GDSS, decision quality of GDSS groups was worse or the same with no support groups; however, in later stages of GDSS use, GDSS groups outperformed no support groups. Their findings support the importance of longitudinal study in developing information system technology. Similarly, Johansen (1976) has observed in the case of teleconferencing systems that initial uses of the system serve as a poor basis for generalising about future uses. Hiltz and Turoff (1981) report "an evolution or pattern of change towards greater complexity and specialisation and diversity of user behavior over time" in computer-mediated conferencing settings. Kiesler (1986) termed the effects that will diminish with group experience with the system as "transient effects of the technology".

Therefore, some researchers (Chidambaram et al., 1990; Jarvenpaa et al., 1988; Sharda et al., 1988; Van Schaik & Sol, 1990; Watson et al., 1988) believe that learning through repeated use of the GDSS may be required before improved performance occurs. So, the results of previous experimental studies based on single-meeting experiments can be vulnerable. However, majority of studies reviewed here show that although their results were based on one time session experiment, the use of a GDSS improves a decision quality compared to no support at all treatment.

## **(ii) GDSSs versus manual structured treatments**

Results are inconclusive. Two studies found the use of a GDSS to improve decision quality (Lewis, 1982; Steeb & Johnston, 1981), while 7 studies showed the use of a GDSS to have no difference in decision quality compared to manually structured method (Beauclair, 1987; Easton et al., 1989; Gallupe, 1990; Gallupe & McKeen, 1990; VanSchaik & Sol, 1990; Zigurs, 1987; Zigurs et al., 1988). Two studies (Bui & Sivasankaran, 1990; Gallupe et al., 1988) have shown that the impact of a GDSS on decision quality is more visible when dealing with more difficult tasks. However, Watson et al. (1988) found that decision quality of GDSS groups was lower than that of manual structured groups, because users suffered from problems of technical unfamiliarity. Easton et al. (1989) and VanSchaik and Sol (1990) strongly argued that improved decision quality of GDSS groups over baseline groups was due to the structured process itself not by computer support. Especially, Gallupe (1990) reported that best members of the group significantly outperformed the GDSS groups, and the best members did not do as well in GDSS supported groups compared with manually structured groups. He explained that the so-called advantages of GDSS use, more democratic participation and anonymity, serve to decrease the ability of the group's best member to get their solution recognised. The GDSS facilitates communication for everyone in the group and not just the best member. He addressed that the system, while facilitating participation by all group members, created an environment, where the best member solution was not adopted by the group.

Majority of the research reviewed here show that there is no distinct difference in decision quality between GDSS and manually structured groups. However, the results also imply that we cannot ignore the possibility of improved decision quality from the use of a GDSS over manual treatment when dealing with particularly complex tasks, or from the repeated use of it.

**Table II-1: Summary of experimental GDSS studies with regard to 2 performance criteria**

	Decision quality	Decision time
<b>Univirsity of Minnesota</b>		
Gallupe ('86)	GDSS > NS (particularly, high difficult task)	GDSS = NS (regardless task difficulty)
Zigurs ('87)	GDSS = MS	
Watson ('87)		(GDSS = MS) longer than NS
Watson et al. ('88)	GDSS < MS, NS	
Gallupe et al. ('88)	GDSS > MSS (particularly high difficult task. due to depersonalisation effect of multi-station)	GDSS longer than MSS
Zigurs et al. ('88)	GDSS = MS	
Gallupe & McKeen ('90)	GDSS = MSS	GDSS longer than MSS
Gallupe ('90)	GDSS = MSS In GDSS: best member > group > ave. member In MSS: best member = group > ave. member	
<b>Univirsity of Arizona</b>		
George et al. ('88)	GDSS > NS	GDSS = NS
Easton, G. ('88)	GDSS = NS	GDSS longer than NS
Jessup et al. ('88)	GDSS > NS (due to anonymity)	
Easton et al. ('89)	(GDSS = MS) > NS	(GDSS = MS) longer than NS
<b>Others</b>		
Lewis ('82)	GDSS > MS, NS	GDSS longer than MS, NS
Beauclair ('87)	GDSS = MS	GDSS = MS
Steeb & Johnston ('81)	GDSS > MSS (due to sensitivity analysis)	GDSS took 12 % longer than MSS
Bui & Sivasankaran ('90)	Low dif. task: GDSS = MSS High dif. task: GDSS > MSS	Low dif. task: GDSS longer High dif. task: GDSS = MSS
Sharda et al. ('88)	First 3 weeks: GDSS = NS Last 5 weeks: GDSS > NS	First 3 weeks: GDSS longer Last 5 weeks: GDSS = NS
Jarvenpaa et al. ('88)	EBB > EWS > NS	
VanSchaik & Sol ('90)	overall GDSS = no GDSS 1-5 sessions: GDSS < no GDSS 6-7 sessions: GDSS > no GDSS (but, predefined process is a much strong factor to improve decision quality than a GDSS. structure is more strong variable than the computer)	

\* MS: manual structured process (same degree of structure with a GDSS),

MSS: manual semi-structured process (loosened structure than a GDSS),

NS: no structured support at all, EBB: electronic blackboard, EWS: electronic workstation.

## **(2) Experimental studies: decision time**

### **(i) GDSSs versus no support treatments**

The use of GDSSs compared to no support treatments has been shown to increase the time required to make a decision (Easton, G., 1988; Easton et al., 1989; Lewis, 1982; Watson, 1987) or to have no effect on time required (Gallupe 1986; George et al., 1988). Sharda et al. (1988) found that GDSS groups compared to no support groups took more time in the first 3 week time period, but showed no difference in the decision time taken in the last 5 week period. Despite the differences in system configurations each other, all of the research reviewed here reveal that there is no benefit from the use of a GDSS compared to a baseline treatment in terms of the decision time saved.

### **(ii) GDSSs versus manual structured treatments**

The use of a GDSS compared to a manually structured process has been shown to increase the time to reach a decision (Gallupe et al., 1988; Gallupe & McKeen, 1990; Lewis, 1982; Steeb & Johnston, 1981) or to have no effect on time required (Beauclair, 1987; Easton et al., 1989; Watson, 1987). While one study (Lewis, 1982) found a GDSS took longer time than a manual structured or a no support process, two other studies (Easton et al., 1989; Watson, 1987) found no time difference between structured supports (either a GDSS or a manual structured), but the structured process group took longer than the no support group. While Gallupe (1986) found that GDSS groups took the same time with no support groups irrespective of the task difficulty, Bui and Sivasankaran (1990) reported that GDSS groups compared to manual structured groups took longer time in dealing with low difficult tasks, and took the same time when handling high difficult tasks. Watson et al. (1988) argue that the electronic medium associated with GDSSs should allow the structure to be invoked and applied more quickly than is possible with a manual system. Like the results in the previous section, however, research reviewed here again shows that there is no benefit from the use of a GDSS compared to a manual treatment in terms of the decision time saved.

## **(3) Field studies**

All of the research results from case and field studies, irrespective of their differences in GDSS conceptions and facilities, show that participants report enhanced decision

quality and shortened meeting time with the use of a GDSS compared to a similar conventional meeting (see tableII-2 below). Especially, Nunamaker et al. (1989) report that 55% of time saving (in terms of project duration, number of meetings, and person-hours) has been achieved with the use of a GDSS (here, Plexsys system) at IBM sites. Phillips (1989a) also notes that agreement is reached much more quickly with the use of a GDSS (here, Decision Conferencing) than it could be achieved by a conventional procedure. Interestingly, two field studies including this one (Chun, 1992; Nunamaker et al., 1989) show that cognitive struggle of participants with the initial GDSS use can be removed by the employment of facilitators. Both studies show that results were independent of the number of sessions that users had participated in.

**Table II-2: Summary of GDSS studies in real world settings with regard to 2 performance criteria**

	Decision quality	Efficiency (mainly, decision time)
<b>Decision Conferencing</b>		
Weiss & Zwahlen ('82)	GDSS better (problem understanding is enhanced due to sensitivity analysis)	GDSS better
Adelman ('84)	GDSS better (due to structured facilitation and S.A.)	
Phillips ('85)	GDSS better (new intuitions emerge, and dig more deeply into the problem ,clarify thoughts using S.A.)	Quicker decision w/GDSS
Phillips ('86)	GDSS better (revenues and profit doubled next year)	Agreement reached more quickly
Volpato ('89)	GDSS better	
<b>Plexsys System at University of Arizona</b>		
Nunamaker et al. ('87)	GDSS better (due to EBS)	GDSS better (due to parallel processing)
Vogel et al. ('87)	GDSS better	GDSS better (particularly, larger groups)
Nunamaker et al. ('88)	GDSS at least as good as manual process	GDSS took longer in the beginning of the session
Vogel & Nunamaker ('88)	GDSS better (more ideas and creativity)	GDSS better
Nunamaker et al. ('89)	GDSS better	GDSS better (55% time saved)
Dennis et al.('90)	GDSS better	GDSS better
Vogel & Nunamaker ('90)	GDSS better (issues fully explored)	GDSS better (due to parallel processing)
<b>Others</b>		
Gray ('83)	GDSS better	
Gibson & Ludl ('88)	GDSS better (better quality of ideas due to Idea Dialog Mode)	No dif.
Zigurs et al. ('89)	GDSS better	

\* S.A.: sensitivity analysis, EBS: electronic brainstorming

## 2.4.2. GDSS effects on user satisfaction

While performance is admittedly the primary dependent variable of interest in information system research, user attitudes (users' perceptions of their performance, their satisfaction with the decision process and outcome, and their intrinsic interest to the system) are also key issues (Lucas, 1978; Sprague, 1980). In the case of a GDSS, user attitudes have been recognised as critical to acceptance and adoption of the technology specially in organisational settings (Dennis et al., 1990; Gallupe & McKeen, 1990). However, like the results of performance variables, previous GDSS studies in user satisfactions show somewhat conflicting results not only between experimental and field studies, but also within experimental research (see table II-3 in page 47, and II-4 in page 49).

### (1) Experimental studies: satisfaction with process and outcome

#### (i) GDSSs versus no support treatments

While, four studies (Gallupe, 1986; Kull, 1982; Watson, 1987; Watson et al., 1988) reported that GDSS groups exhibited less satisfaction compared to baseline groups, two studies (Jessup et al., 1988; Lewis, 1982) reported the higher levels satisfaction from GDSS use. But, four studies (Easton, 1988; Easton et al., 1989; George et al., 1988; Jarvenpaa et al., 1988) found no difference in the level of satisfaction between GDSS and baseline groups. Jessup et al. (1988) interpreted the enhanced satisfaction with the outcome of GDSS groups as due to the anonymous function inherent in their system. Real managers in Kull's (1982) experiment were asked to explain or clarify their reasoning for their voting, ranking, or rating evaluations. This process was intimidating and threatening, so satisfaction from the use of a GDSS was low. One participant put it: "the process shows up those who are not talented" (Kull, 1982, p.82).

Overall, majority of research show that user satisfaction with the use of GDSSs is not higher than that of no support treatments. It is, however, interesting to note that participants' satisfaction with GDSS use is varied according to the system configuration. All of the 4 studies which reported no difference in the level of satisfaction between GDSS and baseline groups, are facilitator-driven GDSSs. But, three out of four studies which found decreased satisfaction from the use of a GDSS are user-driven GDSSs.

## **(ii) GDSSs versus manual structured treatments**

Results are contradictory. Four studies found the use of a GDSS to result in enhanced satisfaction with the decision process compared to a manual structured treatment (Easton et al., 1989; Lewis, 1982; Steeb & Johnston, 1981; Zigurs et al., 1988). But, five studies showed the use of a GDSS to dampen participants' satisfaction with the decision process (Gallupe, 1990; Gallupe & McKeen, 1990; Gallupe et al., 1988; Watson, 1987; Watson et al., 1988). While two studies (Easton et al., 1989; Steeb & Johnston, 1981) reported that the use of a GDSS enhanced participants' perceived satisfaction with the solution, Gallupe et al. (1988) found the decreased satisfaction with the outcome from GDSS groups. Other two studies (Beauclair, 1987; Watson, 1987) reported that there was no difference in the perceived satisfaction with the outcome between GDSS and manually structured groups. Bui and Sivasankaran (1990) reported that satisfaction with the outcome of GDSS groups was particularly increased when dealing with high difficult tasks.

Like the results in the previous section, participants' satisfaction with the GDSS use is strongly affected by the system configuration. Three out of four studies which reported improved satisfaction with GDSS use compared to a manual support, are facilitator-driven GDSSs. But, all of the five studies which found decreased satisfaction are user-driven GDSSs. User-driven GDSS research (Gallupe et al., 1988; Watson et al., 1988) report that participants suffer from problems of technical unfamiliarity in their initial use of a GDSS. They interpret that the group's cognitive struggle to deal with technology can cause dissatisfaction, and sometimes impede the group's performance. They, then, expect that repeated use of a GDSS may reduce these problems. However, according to facilitator-driven GDSS research (e.g., Easton et al., 1989), the enhanced satisfaction of GDSS groups compared to manually structured groups could be attributed to the idea that computer groups thought a GDSS should help them produce a better decision, or that the computer might provide an easier mechanism to record and analyse the data than the use of flip charts. Therefore, it is quite plausible to assume that participants in a user-driven GDSS may suffer from problems of technical unfamiliarity. Other results including Arizona's suggest that this problem can be lessened with the adoption of facilitators. The other possibly important point to be raised is that both types of GDSSs (user-, or facilitator-driven) require users to access the system directly. It would mean that unfamiliarity of keyboard input does not seriously affect the level of satisfaction of the subjects in their studies, even if some research (e.g., Portway 1985) point out that for some, the requirement to express themselves in writing, through a keyboard rather



than orally or even in hand-written form, can be even more inhibiting. It seems to me that problems of technical unfamiliarity arise from cognitive difficulties of how to incorporate system features with the tasks rather than from difficulties of how to access (keyboard) the system.

**Table II-3: Summary of experimental GDSS studies with regard to users' attitudes**

	Satisfaction with		Decision
	Process	Outcome	Confidence
<b>University of Minnesota</b>			
Gallupe ('86)	GDSS < NS (regardless task difficulty)		GDSS < NS (regardless task difficulty)
Zigurs ('87)			GDSS < MS
Watson ('87)	GDSS < NS < MS	No dif.	
Watson et al. ('88)	GDSS < NS < MS (process is confusing due to technical novelty)		NS < GDSS < MS
Gallupe et al. ('88)	GDSS < MSS	GDSS < MSS	GDSS < MSS (regardless task difficulty)
Zigurs et al. ('88)	GDSS > MS (more adaptable)		
Gallupe & McKeen ('90)	GDSS < MSS (in FTF as well as remote setting)		GDSS = MSS
Gallupe ('90)	GDSS < MSS (In GDSS: best member = group, In MSS: best member > group)		GDSS < MSS
<b>University of Arizona</b>			
George et al. ('88)		GDSS = NS	
Easton, G. ('88)	GDSS = NS		
Jessup et al. ('88)	GDSS better, FTF > remote (due to anonymity)		
Easton et al. ('89)	(GDSS > MS) = NS	(GDSS > MS) = NS	
<b>Others</b>			
Kull ('82)	GDSS < NS		
Lewis ('82)	GDSS > MS, NS (feel more creative)		
Beauclair ('87)		GDSS = MS	
Steeb & Johnston ('81)	GDSS > MSS	GDSS > MSS	GDSS > MSS
Bui & Sivasankaran ('90)		Low dif. task: GDSS < MSS High dif. task: GDSS slightly better	
Sharda et al. ('88)			No dif.
Jarvenpaa et al. ('88)	EWS = NS		

\* MS: manual structured process (same degree of structure with a GDSS)

MSS: manual semi-structured process (loosened structure than a GDSS)

NS: no structured support at all

## **(2) Experimental studies: decision confidence**

One of the reasons for using the group to make decisions is to allow a number of people to participate in the decision-making process and thus enhance confidence in the decision made. As we can see from table II-3 above, however, 5 studies from the University of Minnesota found the use of a GDSS to deteriorate users' confidence about their decisions (Gallupe, 1986;1990; Gallupe et al., 1988; Watson et al., 1988; Ziguers, 1987). Gallupe et al. (1988) interpreted this unexpected finding as follows:

"Groups supported by the GDSS tended to generate more possible decision alternatives. They also considered those alternatives in more detail. Because of this condition, these groups had a more difficult choice to make, and once they made a decision, they were possibly less confident because of the number and quality of the choices." But, one study (Steeb & Johnston, 1981) also reported that GDSS groups generated more options and evaluated those options with more criteria in a very systematic manner, so the enhanced decision confidence of the GDSS groups over manual groups was observed. Both research argue that their systems helped participants to generate more alternatives and evaluate those alternatives in more detail. In one study, generation of more alternatives resulted in decreased decision confidence, but in the other study, it was observed to increase the confidence of the participants about their decisions. These different results may be due to the type of the system being used in each study. Steeb & Johnston (1981) system (Perceptronics' Group Decision Aid) is a multi-attribute utility theory based decision analytic model building system, and it is facilitated by an specially trained system operator. DECAID and SAMM of the University of Minnesota basically incorporate rational problem-solving agenda (see DeSanctis & Dickson, 1987). They are designed to facilitate interpersonal exchange of ideas, opinions, and preferences, and perform the basic functions of recording, storing, and displaying relevant informations. Decision analytic computer support models might considerably increase users' confidence about their decision.

## **(3) Field studies**

All of the field studies examined here (note that all of them are facilitator-driven GDSSs) have shown that GDSS use produces high satisfaction and enhanced decision confidence without regard to prior experience with a GDSS (see table II-4 below).

**Table II-4: Summary of GDSS studies in real world settings with regard to users' attitudes**

	Satisfaction with		Decision Confidence
	Process	Outcome	
<b>Decision Conferencing</b>			
Weiss & Zwahlen ('82)	Better (people like fair, adaptable process)		Better (in implementation)
Adelman ('84)	Better (depersonalised process due to MAU model)		Better (well supported and implemented within and after GDSS meeting)
Phillips ('85)	Better (process for shared understanding)		Better
Phillips ('86)		Better (better and acceptable solution)	Better (common purpose and agreed action plan)
Volpato ('89)			Better
<b>the Plexsys System. University of Arizona</b>			
Nunamaker et al. ('87)	Better (mainly due to Electronic Brainstorming)	Better	
Vogel et al. ('87)	Better (8 or more than 3-4 size groups)		Better (support the solution)
Nunamaker et al. ('88)	Better (particularly, larger groups)		Better
Vogel & Nunamaker ('88)	Better		Better (implementation achieved)
Nunamaker et al. ('89)	Better (increased with group size)	better (in goal achievement)	Better (commitment generation)
Dennis et al. ('90)	Better (shared understanding)	Better	Better
Vogel & Nunamaker ('90)	Better (particularly, larger groups)		Better

### **2.4.3. GDSS effects on participation and conflict**

The group decision-making is an important fixture in today's increasingly complex business circumstances. One of the main purposes of group decision making is to bring together different domain of knowledge pertaining to each person, that cumulatively generate a comprehensive picture of a complex task which is beyond the capabilities of any one individual group member, then to promote consensus and acceptance of the decision. To achieve this, participation among members is important (Hall, 1972). So, numerous GDSS research (Huber, 1984; DeSanctis & Gallupe, 1987; Vogel et al., 1987) argue that the main goals of a GDSS are to make meetings more productive through improving group communication activities via encouraging equality of participation and increasing the efficiency of that participation.

#### **(1) Experimental Studies**

##### **(i) GDSSs versus no support treatments**

Five studies (Easton, 1988; Easton et al., 1989; George et al., 1988; Kull, 1982; Lewis, 1982) report the enhanced participation of GDSS groups compared to baseline groups. Three studies (Gallupe, 1986; Watson et al., 1988; Jarvenpaa et al., 1988), however, found no difference in participation between two treatments (see table II-5 below).

##### **(ii) GDSSs versus manual structured treatments**

Six studies found the use of a GDSS to increase the participation among members (Bui & Sivasankaran, 1990; Gallupe & McKeen, 1990; Lewis, 1982; Steeb & Johnston, 1981; Zigurs, 1987; Zigurs et al., 1988). But, 3 studies showed no difference in participation between GDSS and manually structured groups (Beauclair, 1987; Easton et al., 1989; Watson et al., 1988).

White et al. (1980) reveal that the key effect of structured procedures is to increase member participation. Overall results of comparison between GDSS and baseline groups fairly support this finding. Of greater interest is the finding that much research observes the enhanced participation from the use of a GDSS compared to a manual structured support. Technology (e.g., electronic communication channels, individual assured input, anonymity) clearly acts to increase the participation among members.

But, it has a cost. Previous research consistently report the increased conflicts among participants from the use of GDSSs compared to manual structured supports (Gallupe et al., 1988; Watson et al., 1988; Zigurs et al., 1988) as well as no support treatments (Gallupe, 1986; Kull, 1982). Note that all of these results were drawn from the multi workstation-based GDSS settings.

**Table II-5: Summary of experimental GDSS studies with regard to users' participation and conflict**

	Equal participation	Conflict	Consensus
<b>University of Minnesota</b>			
Gallupe ('86)	GDSS = NS	Increased w/GDSS	
Zigurs ('87)	GDSS > MS		
Watson et al. ('88)	GDSS = MS = NS.	Structure positively manages conflicts	No dif.
Gallupe et al. ('88)		Increased w/GDSS (but, not destructive)	GDSS worse than MSS
Zigurs et al. ('88)	GDSS > MS	Increased w/GDSS	
Gallupe & McKeen ('90)	GDSS > MSS		
<b>University of Arizona</b>			
George et al. ('88)	GDSS > NS		No dif.
Easton, G. ('88)	GDSS > NS		GDSS worse than NS
Easton et al. ('89)	(GDSS = MS) > NS		
<b>Others</b>			
Kull ('82)	GDSS > NS (due to personal assured input terminal)	Increased w/GDSS (due to public display of voting and need to explain one's position)	GDSS worse than NS
Lewis ('82)	GDSS > MS, NS		
Beauclair ('87)	GDSS = MS		
Steeb & Johnston ('81)	GDSS better (due to individual assured input)		GDSS better
Bui & Sivasankaran ('90)	GDSS > MSS (also, reduce the influence of dominant members)		
Jarvenpaa et al. ('88)	EWS = NS		

\* MS: manual structured process (same degree of structure with a GDSS)

MSS: manual semi-structured process (loosened structure than a GDSS)

NS: no structured support at all

EWS: electronic workstation

## (2) Field studies

As we can see from table II-6 below, previous field multi workstation-based GDSS research (Arizona, and others) also consistently report the enhanced participation and increased conflict from the use of the system.

**Table II-6: Summary of GDSS studies in real world settings with regard to participation and conflict**

	Equal participation	Conflicts	Consensus
<b>Decision Conferencing</b>			
Weiss & Zwahlen ('82)	GDSS better	GDSS better (sense of closure)	GDSS better (unified understanding of entire issues)
Adelman ('84)			GDSS better
Phillips ('85)	GDSS better		GDSS better (incorporate the differing perspectives of the members in the group)
Phillips ('86)			GDSS better (shared understanding of the issues)
Volpato ('89)			GDSS better
<b>Plexsys System at University of Arizona</b>			
Nunamaker et al. ('87)	GDSS better (due to anonymity:domination decreased)	GDSS worse	
Vogel et al. ('87)	GDSS better (anonymity)	GDSS worse	
Nunamaker et al. ('88)	GDSS better (domination decreased wth anonymity)	GDSS worse (due to anonymity)	GDSS better (sharing of group vision is achieved through much negotiation)
Vogel & Nunamaker ('88)			GDSS better
Nunamaker et al. ('89)	GDSS better		
Dennis et al.('90)	GDSS better		GDSS better (stronger agreement)
Vogel & Nunamaker ('90)	GDSS better (due to voting & anonymity)	Increased as well as decreased with GDSS	
<b>Others</b>			
Gibson & Ludl ('88)	GDSS better (due to Idea Dialog Mode)	GDSS worse (more inhibition and politics rather than openness and trust)	
Zigurs et al. (89')	GDSS better	GDSS worse	

Researchers explain the enhanced participation among members as due to the individual workstation. Many multi workstation GDSS researchers (Nunamaker et al., 1988;1989; Siegel et al., 1986) claim that an individual workstation provides a framework within which group members who are reluctant to contribute are encouraged to participate and potentially influence the group discussion. Arizona researchers have continuously found the anonymity of electronic communication to increase the number of interpersonal exchanges and reduce the probability of any one member dominating the meeting. Kull (1982) report that by giving each participant an assured input in the decision process, domination by one or two individuals is minimised. Steeb & Johnston (1981) also report that each group member experiences equal participation in the decision process through individual computer-entry of required probability and utility values. However, anonymity function inherent in multi workstation GDSSs was found to heighten conflict within the group as members tend to become more aggressively communicate each other: members tend to express themselves more forcefully and are often not as polite when interfacing through the system rather than in person (Jarvenpaa et al., 1988; Nunamaker et al., 1988; Vogel & Nunamaker, 1987; Watson et al., 1988). Kiesler (1986) and Siegel et al. (1986) also address that the electronic medium of communication results in a loss of social context cues, which results in more uninhibited behaviour- strong and inflammatory communication among members. Gallupe et al. (1988) argue that their system (here, individual terminal and public screen) disassociates participants from the alternatives they entered into the system. This results (1) more alternatives in more objective evaluation in more detail, without the necessity of possibly defending previously stated postures, and then (2) higher level of conflict, less agreement with the final decision, and less satisfaction with the decision process. Similarly, Kiesler et al. (1984) also point that heightened awareness of member's viewpoints and greater objectivity in reviewing proposed ideas or solutions to a problem through anonymity of message may raise the level of conflict in the group. Turoff and Hiltz (1982) and Gallupe (1985) also report that added participation through the use of electronic communication channel makes consensus more difficult to achieve.

DeSanctis and Gallupe (1987) argue that the electronic communication component within a GDSS will increase the social distance (perceived physical distance) among members as electronic communication is substituted for at least some direct verbal communication, which, in turn, will affect interpersonal attraction and group cohesion. In practice, Watson et al. (1988) report that the heightened interaction through the electronic medium, coupled with greater human-computer interaction relative to human-human interaction, seemed to increase the sense of distance among members. The sense of distance, then, increased aggressive communication and

conflict among members. But, they conclude that the presence of a suggested structure for the group meeting improved the degree of post-meeting consensus. The positive intended outcomes of imposing a structure seem to outweigh the negative impacts of more aggressive communication (caused by technology). Kull (1982) also found that the use of electronic media (here, public display and multi workstation) reduced the social cues and social interaction of a meeting, therefore increased conflicts.

However, field studies of a single-workstation based GDSS (here, a Decision Conferencing) in table II-6 have also consistently found the enhanced participation and consensus from the use of the technology (Adelman, 1984; Phillips, 1985;1986; Volpato, 1990; Weiss & Zwahlen, 1982).

## 2.5. Chapter Summary and Implications

### 2.5.1. Summary

*Overall, research shows that the use of a GDSS improves a decision quality compared to no support at all treatment, but there is no distinct difference in decision quality between GDSS and manually structured groups.* As Easton et al. (1989), VanSchaik and Sol (1990), and Watson et al. (1988) addressed, the improved decision quality from the use of a GDSS might be due to the structured process itself not by computer support. However, the research also indicates that *we cannot ignore the possibility of improved decision quality from the use of a GDSS over a manual treatment when dealing with particularly complex tasks, or from the repeated use of it.* Interestingly, one study (Gallupe, 1990) found that best members of the group significantly outperformed the GDSS groups, and the best members did not do as well in GDSS supported groups compared with non-GDSS supported groups: use of a GDSS, while facilitating participation of all, does suppress the contribution of the best group member.

The electronic medium associated with GDSSs should facilitate the group decision process by speeding up the clerical work necessary for the functioning of the process, and at the same time acting as a "group memory." Previous experimental research, however, show that *GDSS groups usually took longer or at best the same time in arriving their decisions compared to manually structured process support or baseline groups,* without regard to whether the system was a facilitator-driven or user-driven GDSS. One longitudinal study reported that meeting time of GDSS groups was not shortened even with the repeated use of the system compared to baseline groups. *Although most*



experimental research results were based on one time session experiment, longer decision time of GDSS groups without distinctive improvement in decision quality, compared to manually structured groups is problematic.

However, results of most case and field studies show that despite a fundamental differences in system configurations employed in each reasearch (e.g., whether it is a facilitator-driven or a user-driven; a single workstation-based or a multiple workstation-based GDSS), most field studies report that participants experience the improved decision quality and efficiency from the initial use of a GDSS compared to a similar conventional meeting.

As far as user satisfaction is concerned, the results of the University of Minnesota consistently show less satisfaction with the GDSS use compared to the conventional method. However, Arizona researchers report that the satisfaction of GDSS groups were at least as good as baseline groups. Other two studies (Lewis, 1982; Steeb & Johnston, 1981) even report the enhanced satisfaction of users with GDSS use. The main reason for these inconsistent findings between the researchers may be due to the differences in their system design: whereas the Minnesota system is a user-driven GDSS, others are facilitator-driven GDSSs. It is, then, plausible to assume that participants in a user-driven GDSS may suffer from problems due to their lack of familiarity with the technology. Results from facilitator-driven GDSSs research suggest that this problem can be lessened with the adoption of facilitators. Note that both types of GDSSs require participants to keyboard by themselves. So, the problems of technical unfamiliarity may be more associated with the subject's cognitive difficulty of how to incorporate system features and the tasks, rather than with the uneasiness of how to access the system. The degree of participants' confidence about their decision seems to be affected by the type of the system being used in each study. User confidence was observed to be significantly improved in a decision analytic model building GDSS setting. But, Minnesota researchers have consistently reported that use of the GDSS tends to lessen the group confidence in the decision, in which the system is mainly designed to facilitate interpersonal exchange of informations.

All of the field studies examined here (note that all of them are facilitator-driven GDSSs) showed that GDSS use produces high satisfaction, and enhanced decision confidence without regard to the amount of prior experience with a GDSS.

Previous multi workstation-based experimental GDSS research has consistently reported the enhanced participation of GDSS groups compared to manual structured groups.

Technology (e.g., electronic communication channels, individual assured input, anonymity) clearly acts to increase the participation among members. However, the research has also consistently reported that conflicts among members are increased from the use of multi workstation-based GDSSs compared to manual structured supports as well as no support treatments. Previous multi workstation-based field GDSS research also consistently report the enhanced participation and increased conflict from the use of the system. Although, proponents of multi workstation-based GDSSs assume that GDSSs should foster even participation and heighten group consensus, electronic communication channels enhance the equality of participation with the cost of the increased conflict. However, field studies of a single-workstation based GDSS (here, a Decision Conferencing) have consistently found the enhanced participation and consensus from the use of the technology.

### **2.5.2. Implications**

The important question posed by this review of prior research is: what are the reasons for the inconsistent results between field and laboratory research, and especially within experimental tests? Nunamaker et al. (1989) caution that the contradictory results between field experiences and many experimental studies are indeed a problem if results of academic research are to be applied effectively in business settings. Some research (Jarvenpaa et al., 1988) questions whether groupware (a GDSS) in face-to-face meetings is simply not functionally advantageous or whether the lack of positive effects from using groupware is a result of serious limitations in the existing laboratory research. My general impression from this review is that it seems to be both. On the one hand, some technical configurations certainly cause negative effects as well. For example, it becomes clear that conflicts are increased in a multi workstation-based GDSS. Unlike a facilitator-driven GDSS, participants in a user-driven GDSS show less satisfaction with the initial use of the system due to the problems of technical unfamiliarity. On the other hand, the distinctive difference in the results between field and laboratory research may imply that the real effectiveness of a GDSS can only be recognised when real managers use it to tackle their very live and formidable tasks. Of course, we can not rule out the possibility that the results of field studies may be affected by investigator's subjective optimism: the results were mainly based on anecdotal evidence rather than on rigorous measurement. But, results from all case and field studies reviewed here consistently show the positive effect of a GDSS regardless of different technical design configurations (e.g., one is people-centred, and the other is computer-centred (Phillips, 1988)), softwares, type of tasks, and measuring methods employed. The positive responses of real managers are

especially relevant, given the maturity of the session participants and their familiarity with an equivalent conventional process. Many experimental researchers also explained their discouraging findings as due to the lack of prior experience of users with the system, inappropriateness of the task, immaturity of software, one-time session experiment, etc.

This study is not meant to be a critique of the use of laboratory experiments as a means for productively exploring GDSS research. Nor is the purpose of this study to explore the pros and cons of laboratory versus field research. The coverage of these methodological issues related to decision making and GDSS is available elsewhere (Cook & Campbell, 1979; Dennis et al., 1989; Gallupe et al., 1988; Watson et al., 1988; Winkler & Murphy, 1973). In fact, some GDSS research (Gallupe et al., 1988; Watson et al., 1988; Gallupe & McKeen, 1990) provides clear reasons for their concentration on laboratory experiments. Briefly, experimental laboratory research provides a controlled investigation of a limited set of factors, but suffers from a lack of generalisability. Field studies provide high generalisability, but suffer from a lack of control. As such, there is a need for GDSS research programmes encompassing both experimental and field study techniques (Dennis et al., 1989). Few researches, however, bring to bear the appropriate analytic techniques to tease out these relationships (Vogel et al., 1990). Thus in the meantime, it is important to understand the differences between the phenomena being investigated with each research methodology, so that differing results can be better integrated. This topic will be discussed in detail at the next chapter.

## CHAPTER 3. FACTORS FOR DIFFERENT RESULTS IN GDSS RESEARCH

Many authors (Dennis et al., 1988;1989; Gallupe, 1986; Jarvenpaa et al., 1988; Nunamaker et al., 1988;1989; Phillips 1989b; Pinsonneault & Kraemer, 1989; Sharda et al., 1988; Valacich et al., 1989; Van Schaik & Sol, 1990; Vogel et al., 1987;1990) have suggested clues for the inconsistent findings in previous GDSS research. Different results occur due, in part, to differences in:

1. contextual pressures
2. tasks
  - (1) type of tasks (hypothetical versus real tasks)
  - (2) degree of task complexity
  - (3) structure of tasks (whether it has a right or wrong answers, or better or worse answers)
  - (4) particular task characteristics inherent in each decision-making phase (e.g., idea generation task, preference reconciliation task, choice task)
3. group characteristics
  - (1) subjects (students versus business professionals)
  - (2) group development stage
  - (3) group norms
  - (4) group size
4. GDSS configurations: multiple versus single workstation
5. measures employed and degree of control for the experiments

As Vogel and Nunamaker (1990) pointed out there is a need to recognise the importance of multidirectionally interacting relationships between these variables.

### 3.1. Contextual Pressures

Decision makers in actual organisational settings may be subject to a variety of pressures and constraints not easily investigated in laboratory settings. O'Reilly et al. (1987) argue that in order to understand how information is used and decisions are made by real-world decision makers, studies need to account for the contextual pressures that affect decision makers' willingness and ability to search for and use information in the actual performance of their duties. This is an important consideration since a number of studies (Beach, 1975; Ebbesen & Kocnecni, 1975; Svenson, 1979) suggest that decisions made under the artificiality of the laboratory

situations may not correspond with the same decisions made in living world. Several authors (Connolly, 1977; Slovic et al., 1977; Winkler & Murphy, 1973) also suggest that laboratory evidence about information use and decision making may not be an adequate representation of the real world.

O'Reilly et al. (1987) suggest three factors of contextual pressures, which can be seen in the form of reward and punishment systems, hierarchy and authority, coordination and control, and others, all having the result of securing conformity and compliance from organisational participants:

- i) incentive systems, which act to encourage the pursuit of certain goals and discourage others; and
- ii) organisational structure, which acts to restrict and channel information flows and establish a system of roles, authority, and expertise;
- iii) group pressures (norms), which are both formal and informal and which make salient desired attitudes and behaviours.

Decision makers are subject to formal and informal norms, operate within a role set, and are usually required to "live with" the results of the decisions they make. In this setting, issues and problems are interrelated, and so decision makers seldom focus on a single problem and a single set of informational cues. Mason and Mitroff (1981) argue that every time policymakers attempt to solve a particular policy problem they must consider its potential relationship with all other problems. It means that there may be increased reliance on the group both for the information necessary to make the decision and their acceptance and compliance with the decision.

O'Reilly et al. (1987) concluded that unless these contextual or situational influences on decision makers' propensities to seek out and use information are investigated, findings about information processing and decision-making behaviour may not possess the external validity to be useful in understanding organisational decision-making. This conclusion can be exactly applied to the GDSS study. In previous chapter, we saw that experimental GDSS studies reported inconsistent findings with regard to decision quality. We also saw that experimental GDSS groups usually took longer time in arriving their decisions than manually structured process support or baseline groups. However, most field studies reported that participants experience the improved decision quality and efficiency from the initial use of a GDSS compared to a similar conventional meeting, without regard to the differences in system design (whether it is a facilitator-driven or a user-driven; a single workstation-based or a multiple workstation-based GDSS). Contextual pressures may be one of the important reasons for the differences in the findings between experimental and field GDSS studies.

GDSSs do not exist apart from the group and organisational contexts or the external environment of organisations (Ives & Davis, 1980; Markus, 1984). Table III-1 highlights some of the more important distinctions in information management needs of users between laboratory and field studies used in GDSS research.

**Table III-1: Differences in information cues between laboratory and field GDSS studies**  
(Adapted from O'Reilly et al., 1987)

In laboratory studies, the information cues typically:	In field studies, the information cues typically:
- are provided to participants in case	- are often difficult to distinguish, available but not easily accessed
- are obtrusive and reactive	- are unobtrusive and nonreactive
- are written	- are verbal
- are relevant only to the set of tasks at hand; the experiment creates its own context	- are relevant to a broad set of tasks
- emanate from a "neutral" source with which the subject is unfamiliar	- come from a wide variety of fragmented sources of varying degrees of objectivity and accuracy
- are not verifiable through feedback	- can be checked for accuracy
- are limited in the number of cues which are methodologically feasible in any one study - have no interpersonal content	- are interpersonally, socially, culturally, and sequentially embedded

### 3.2. Tasks

Virtually all group researchers agree that group performance cannot be studied generically without regard to task, and that an individuals' performance is without question affected by the type and characteristics of the task (McGrath 1984; Poole 1983). In some research, the nature of the task has accounted for as much as 50% of the variance in group performance (Poole et al., 1985). Task determines the need for information and the consequent communication practices of the decision-making group. Therefore, task differences in GDSS research can have a major impact on the research results. In fact, in their experimental test, Zigurs et al. (1988) showed that task demands are an important determinant of how computer support is viewed and used: the characteristics of the task ( e.g., the degree of difficulty, and the extent and type of structure inherent in the task: problem finding, resolving conflict, choice task, and etc.) appeared to affect the way in which groups used the technological support provided. Many group dynamics researchers have tried to classify tasks in ways that relate meaningfully to how groups perform them. Excellent review of classifications of tasks is provided elsewhere (Goodman, 1986; McGrath, 1984; Shaw, 1981). GDSS researchers have also attempted to investigate the effect of tasks on how computer

support is viewed and used. Here, we examine the effects of task differences on GDSS results based on type of task, degree of task complexity, structure of task, and task characteristics inherent in each decision-making phase).

### **3.2.1. Type of tasks: hypothetical versus real**

One of the important factors which distinguish hypothetical tasks to real ones may be the degree of stimulation to participants. Participants in case and field GDSS studies are working on solving their own on-going problems instead of problems assigned to them by researchers. They usually have their own stake in the task. It is simply impossible to find tasks for experiments that can so stimulate participants as do real tasks. The degree of desire (or responsibility) to solve their own problems or fictitious ones can make a difference in the extent of a GDSS use and the perception of GDSS use. Kull (1982) pointed to a pitfall in using a simulated case to study the behaviour of higher level managers in a GDSS (software: Mindsight) environment: "even if the simulation was based on an actual situation, the fact that all participants were familiar with the case had to influence their use of the system to some degree."

Type of task may be one of the important variables to explain the contradictory results between field and experimental GDSS studies.

### **3.2.2. Task difficulties**

While hypothetical tasks in experimental studies are usually isolated from the external world (the experiment creates its own context, and all necessary information is provided to participants in case packages), real tasks are socially, culturally, interpersonally, and sequentially interrelated with other problems. So, business professionals seldom focus on a single problem as much as participants in experimental studies do. Also, experimental tasks must be suitable for the experimental subjects (usually students) and the time for which they have agreed to participate (mostly one session with at most a few hours, but typically less than one hour) (Dennis et al., 1989). However tasks addressed by business professionals in field studies have been explored in two days (Phillips, 1985;1988;1989a) or in several layers requiring several sessions (Dennis et al., 1990) to address fully. It means that the complexity of experimental tasks is far below the complexity of tasks faced by business groups.

A number of researchers in group decision-making have shown that task difficulty is a major factor that affects group performance in terms of outcome quality and group

process (Fisher, 1981; Roby & Lanzetta, 1958; Shaw, 1973). Some GDSS researchers (Gallup et al., 1988; Dennis et al., 1988) contend that problems with high complexity lend themselves well to the use of decision aids because the various tools available can assist by providing memory aids, some structure otherwise difficult to visualise, and sensitivity analysis that allows the users to assess the impact of a decision on the various interacting variables. On the other hand, decision tasks of lower difficulty are expected to require less information exchange among group members, and less intellectual effort (cognitive load) to analyse and evaluate the information used in making the decision than more difficult tasks (Hackman, 1968; Shaw, 1932). This implies that there may be few advantages or even undermining effects to using a GDSS for decision tasks of lower difficulty; in fact, use of a GDSS may actually impede the group in their decision making if the technology "overwhelms" the problem or "becomes more trouble than it's worth" (Gallupe et al., 1988; Vogel & Nunamaker 1987). There is much evidence that using a GDSS for problems of low complexity is not worthwhile due to the "overhead cost" involved in using the sophisticated tool (Bui et al., 1987; Dennis et al., 1988; Gallupe & McKeen, 1990; Jarvenpaa et al., 1988; Zigurs et al., 1988). Some experimental research (Bui & Sivasankaran, 1990; Gallupe, 1986; Gallupe et al., 1988) has shown that decision quality was particularly improved with a GDSS use for more complex problems. Most field GDSS studies report the improved decision quality and efficiency of the decision-making process from the use of a GDSS compared to a similar conventional meeting. Thus, it seems clear that task difficulty is one of the important variables to explain the contradictory results between GDSS studies, especially laboratory and field ones.

### **3.2.3. Structure of tasks: right or wrong answers versus better or worse answers**

The other important difference in the tasks between the experimental and field GDSS studies is whether they have right or wrong answers, or better or worse answers. To measure the effectiveness of a system in a limited short time period, laboratory GDSS research generally uses the task with right or wrong answers for their experiments. Subjects (mostly students) in the experiments also share similar perspectives and data on the task each other. However, the nature of the ill-structured tasks in real world precludes knowing a "correct" solution. As Mason and Mitroff (1983) commented, for ill-structured problems there is no criterion to determine a solution correct or false: solutions are at best judged as good, bad, reasonable, but never correct or false. Watson et al. (1988) also argue that many organisational meetings occur without prior or post knowledge of the "correct" outcome of a group meeting. Managers also bring a



different set of relevant data and their own role-defined perspective on the issues. In such situations, groups must often resolve competing personal preferences and maximise agreement on a solution to a problem. Then, it is not surprising to notice the different results between experimental and field research.

#### **3.2.4. Task characteristics inherent in each decision making phase**

Some researchers (Lyles, 1981; Mintzberg et al., 1976; Pounds, 1969) have described the decision process as involving a number of distinct phases (such as issue diagnosis, solution generation, consensus reaching, and choice) - that at any one point in the decision process, a particular type of decisional activity dominates all the others, and that decision-makers' attention is focused on one phase at a time. Other research (Janis, 1989; Russo & Schoemaker, 1991) strongly suggests the improved performance of group problem-solving when following the structured process. Hackman and Kaplan (1974) find that the only meaningful difference between successful and unsuccessful problem-solving groups is that successful groups tend to devote adequate time to problem formulation and procedural matters (planning of meeting process), whereas unsuccessful groups tend to immediately begin to search for alternative solutions.

Based on this phase-associated decision-making assumption, researchers mainly from the University of Minnesota have investigated the effect of GDSS use on the group performance by varying the task characteristics inherent in each decision making phase (see table III-2, -3 in page 64, and -4 in page 65).

**Table III-2: Categorisation of experimental GDSS research based on task characteristics in each decision-making phase (the University of Minnesota)**

	Decision quality	Satisfaction with process
<b>PROBLEM FINDING (ISSUE DIAGNOSIS) TASK</b>		
Gallupe ('86)	GDSS > NS	GDSS < NS
Gallupe et al. ('88)	GDSS > MSS	GDSS < MSS
<b>CONSENSUS REACHING TASK</b>		
Gallupe ('90)	GDSS = MSS	GDSS < MSS
Gallupe and McKeen ('90)	GDSS = MSS	GDSS < MSS
Watson et al. ('88)	GDSS < MS, NS (but, overall performance: GDSS = MS > NS)	GDSS < NS < MS
<b>CHOICE TASK</b>		
Zigurs et al. ('88)	GDSS = MS (but, overall performance: GDSS = NS > MS)	GDSS > MS

\* MS: manual structured process (same degree of structure with a GDSS)

MSS: manual semi-structured process (loosened structure than a GDSS)

NS: no structured support at all

**Table III-3: Categorisation of experimental GDSS research based on task characteristics in each decision-making phase (Others)**

	Decision quality	Satisfaction with process
<b>IDEA GENERATION TASK</b>		
Lewis ('82)	GDSS > MS, NS	GDSS > MS, NS
<b>CONSENSUS REACHING TASK</b>		
Beauchair ('87)	GDSS = MS	
Jarvenpaa et al. ('88)	EBB > EWS > NS (but, overall performance: EBB > EWS > NS)	EWS = NS
<b>CHOICE TASK</b>		
Bui et al. ('87)	GDSS = MS	

\* MS: manual structured process (same degree of structure with a GDSS)

MSS: manual semi-structured process (loosened structure than a GDSS)

NS: no structured support at all

EBB: electronic blackboard

EWS: electronic workstation

**Table III-4: Task characteristics used in experimental GDSS research**

RESEARCHER (S)	TASK
	<b>PROBLEM FINDING (ISSUE DIAGNOSIS) TASK</b>
Gallupe ('86)	"Bonanza Business Case" (A firm is losing profits at the same time sales are rising.)
Gallupe et al. ('88)	Revised "Bonanza Business Case"
	<b>IDEA GENERATION TASK</b>
Lewis ('82)	Severe financial problems in a university
	<b>CONSENSUS REACHING TASK</b>
Gallupe ('90)	Modified "Bonanza Business Case" (set priority for competing projects under limited funds)
Gallupe and McKeen ('90)	Modified "Bonanza Business Case" (find out and agree with the cause of company's problem by rank choice)
Watson et al. ('88)	Resolving conflicts of personal preference in money allocation
Beauclair ('87)	Policy formation for student misconduct at a university (find out and reach agreement)
Jarvenpaa et al. ('88)	Unstructured, high-level conceptual software design (find out and reach agreement)
	<b>CHOICE TASK</b>
Zigurs et al. ('88)	Choosing from an applicant pool: alternatives and criteria were known.
Bui et al. ('87)	Selecting a regional director from an applicant pool

Table III-2 above categorises the research findings of the University of Minnesota according to the task characteristics in each decision-making phase. As we can see from table III-2, in problem finding tasks, GDSS groups show enhanced decision quality, but increased dissatisfaction with the process over manual or no support groups. In consensus-reaching tasks, while two studies (Gallupe, 1990; Gallupe & McKeen, 1990) show no difference in decision quality between GDSS and manually structured groups, one study (Watson et al., 1988) shows decreased decision quality in GDSS groups compared to manual structured or baseline groups due to the technical intrusion problem. But, all of them report the less satisfaction with the GDSS use compared to manual or baseline treatments. In choice tasks, GDSS groups show no advantage in decision quality over manual groups, but their degree of satisfaction with the process is relatively higher than manual groups.

They have explained the mixed results of their experimental studies by the particular task characteristics inherent in each phase of decision-making process. For example, Zigurs et al. (1988) suggested that the characteristics of the choice tasks used in their study appeared to affect the way in which groups used the technological support provided. Due to the characteristics of choice tasks, according to their interpretation, the manual groups had difficulty incorporating both the task structure and the process structure (i.e., the manual agenda) into their decision-making routine. However, the

electronic structure, in the form of the GDSS, proved more adaptable than the manual structure. They, then, conclude that the effectiveness of a group's adaptation of support technology is partially a function of the match between the group's view of task demands and its view of the technology. That is, the key to significant effectiveness increases in computer support of groups may be in both the adaptability of the system to the task and the adaptability of the group in their view of the system's utility and meaning. In short, one particular type of GDSSs may be more effective in dealing with one particular type of task rather than the others.

Can these interpretations be generalised to other settings (e.g., different GDSS facilities) ? Table III-3 may give a partial answer to this question. As we can see in table III-3, the results of other research show a somewhat different picture from the Minnesota study. Lewis (1982) showed enhanced decision quality and satisfaction with the process of GDSS groups over manual or no support groups in the idea generation task. In a consensus-reaching task, Jarvenpaa et al. (1988) found enhanced decision quality in GDSS groups over baseline groups, but no difference in satisfaction with the process between two groups. Unlike the negative reactions of GDSS use reported in most Minnesota research, Jarvenpaa et al.(1988) report that the participants largely agreed that a GDSS (electronic communication media) was interesting and held promise irrespective of its technical immaturity which caused cognitive overload to participants. The findings from the field studies also show a somewhat different picture from the Minnesota study. As we saw in previous chapter, most case and field studies reported the improved decision quality, efficiency, and satisfaction from the use of a GDSS compared to a similar conventional meeting. Unlike the experimental issues, real world issues always require managers to exercise all of the major task characteristics inherent in each decision-making phase (information gathering, alternatives development, alternative evaluation, consensus reaching, and alternative selection) together. As Jarvenpaa et al. (1988) added, the variables of team difference and leader's enthusiasm to use the technology may be more important factors to determine the adoption and effectiveness of a GDSS. Similarly, Zigurs et al. (1988) identified the importance of group norms: one group chose not to use a GDSS in their problem solving, because they did not want to change their existing group work patterns.

### 3.3. Group Characteristics

*"(The master sculptor) Caro takes pieces of metal that in themselves are inert, anonymous, inexpressive..... These pieces he treats as Matisse treated individual colours: in the belief, that is to say, that none of them is beautiful in itself, but that all can become beautiful in their relation to others." art critic John Russel (1986)*

Individuals usually belong to many types of groups, but groups are not just any aggregation of two or more people. Although there are many ways of classifying groups, depending on a person's perspective (e.g., see Shaw, 1981), most existing definitions, however, stress the ideas of common perception, common goal, interdependence and interaction, history, size, and organisational structure (particular norms and procedures in a certain group). In other words, they are more concerned with the principle of groupness. Groupness is the identity of a group which is apart from the identities of the individual members- that is, a group is more than sum of its parts. Brilhart (1978, pp.20-21) specifies 5 characteristics of a group:

- (1) A number of people sufficiently small for each to be aware of and have some reaction to each other (that is, size and common perception).
- (2) A mutually interdependent purpose in which the success of each is contingent upon the success of the others in achieving this goal (that is, common goal).
- (3) Each person has a sense of belonging or membership, identifying himself or herself with the other members of the group (that is, common perception and interdependence).
- (4) Not all of the interaction will be oral, but a significant characteristic of a discussion group is reciprocal influence exercised by oral interaction (that is, interaction).
- (5) Behaviour based on norms and procedures accepted by all members (that is, history and organisational structure in the group).

In this section, we examine group differences as one explanation for the different GDSS research results.

#### 3.3.1. Subjects: students versus business professionals

Many of the past experimental GDSS studies used groups of students formed solely to address a task created for an experiment. Experimental groups were not created because they had the desire to solve a particular problem but to conduct an experiment (Nunamaker et al., 1988). Therefore, they rarely have a vested interest and responsibility in the outcome of the studies and are likely to be less enthusiastic than field study groups (Nunamaker et al., 1989; Tetlock, 1985). Groups in the field

tend to bring together different facets or domain of knowledge that cumulatively yield a comprehensive picture of a complex area exceeding the capabilities of any individual group member (Dennis et al., 1988). However, subjects in the experiment (mostly, students) tend to bring together overlapping ability and knowledge relative to the task at hand. The implication is that the effectiveness of a GDSS may become more apparent when it deals with diverse opinions of group members. The other possible reason for the different results between field and laboratory research may be the subject's ability to compare GDSS use with a conventional method. Some studies (Dennis et al., 1988; Nunamaker et al., 1989) point out that it is extremely difficult to measure differences in satisfaction unless groups have experienced both conventional and automated support for equivalent tasks. Whereas subjects in field studies are quite familiar with an equivalent manual process, those experiencing the automated support in laboratory settings may lack the ability of real world users to compare GDSSs use with conventional means of accomplishing the same tasks. Table III-5 below highlights some of the more important distinctions in the subjects between laboratory and field GDSS studies (O'Reilly, 1987). These differences of the subjects can, in part, clearly explain the different results between field and experimental research.

**Table III-5: Differences between laboratory and field studies (O'Reilly et al., 1987)**

In laboratory studies, the decision makers usually:	In field studies, the decision makers usually:
- are passive receivers	- are senders as often as receivers
- are focused on a limited set of cues	- are concerned with multiple ones
- have little experience with the task	- are well experienced with the task
- have little vested interest in the long term except for the one set by experimenter	- have potentially conflicting goals
- operate with artificial time pressures	- operate with a variety of time pressures
- have little vested interest in long term results	- are responsible for long term results
- are clearly identified	- are often unidentified
- are unconcerned with interpersonal relationships	- must deal with interpersonal as well as task relationships

These differences imply that future experimental GDSS research should use real world subjects if results are to have greater external validity.

### 3.3.2. Group development stage

Relationships and groups do develop and grow from the early stages of getting acquainted to the mature stages of effective, smooth functioning, and ultimately to stable states and stagnation (Schein, Vol.1, 1988, p.80). Tuckman (1965) suggests that

most groups go through a four-stage developmental sequence: forming, storming, norming, and performing. He notes that groups simultaneously confront two kinds of problems in each stage of group development. He labels these two problem types: (1) group structure and (2) task activity. The types of group maintenance (social) behaviours and task-oriented behaviours often observed in groups differ from stage to stage. Follows are the task-oriented and group-maintenance behaviours which might be found in each of these stages (Large segments of this description were adapted from Hellriegel et al. 1986, pp.237-239; Schein, Vol.1, 1988, pp.40-59, pp.76-83; and Tuckman 1965, pp.384-399):

**(1) Forming (testing and independence; attempting to identify the task)**

In this stage, task-oriented behaviours focus on the members' efforts to define goals and develop procedures for performing their tasks. Group maintenance behaviours are concerned to discover what is considered an acceptable behaviour. So, defining group boundaries and group rules is important. People are getting acquainted and understanding leadership and other member roles. They might: (i) keep feelings to themselves until they know the situation; (ii) act more secure than they actually feel; (iii) feel confused and uncertain about what is expected of them; (iv) be nice and polite, certainly not hostile; (v) try to size up the personal benefits relative to the personal costs of being involved in the group.

**(2) Storming (development of intragroup conflicts; emotional response to task demands)**

This is a period of high emotionality. Competition and conflict is a dominant theme at this stage. Conflicts over task behaviours emerge with respect to the relative priorities over goals, who is to be responsible for what, and the task-related guidance and direction of the leader. Group-maintenance behaviours are a mixture of expression of hostility and infighting. Nevertheless, it is important that the conflict should not be suppressed or withdrawn. Suppressing conflict will likely create bitterness and resentment, which will last long after the members' attempts to express their differences and emotions; withdrawal can cause the group to fail more quickly.

**(3) Norming (development of group cohesion; expression of opinions)**

A sense of shared responsibility for the group develops. Cooperation within the group is a dominant theme at this stage. Task-oriented behaviours in this stage evolve into a sharing of information, acceptance of differences in opinions, and positive attempts to reach mutually agreeable or compromise decisions on the group goals and the rules by which the group will operate. Group-maintenance behaviours focus on empathy, concern, and positive expressions of feelings leading to group cohesion. Members are

likely to develop a sense of closeness, an interacting communication network, a division of labour, and norms designed to protect the group from disintegration. Sometimes, holding the group together may become more important than successful task accomplishment.

#### **(4) Performing (functional role-relatedness; emergence of solutions)**

This stage relates to how effectively and efficiently the group is able to perform its tasks. However, performance of groups differs after the norming stage. Some groups continue to learn and develop from their experiences and new inputs, thus continuing to improve their efficiency and effectiveness. Other groups may perform only at the level needed for their survival, especially when there exist the excessive self-oriented role behaviours, the development of negative group norms, and the poor group leadership.

Group dynamics research (Borman, 1970; McGrath, 1984) have pointed out the drawbacks of using zero-history groups to study group behaviour and the inconsistent findings that may result. GDSS researchers (Bui et al., 1987; Dennis et al., 1989; Fedorowicz, 1986; Kiesler, 1986; Watson et al., 1988; Zigurs, 1987) also point out the importance of using groups with a meaningful history and future. However, most laboratory GDSS studies have examined the effect of computer support during the first (and in fact the only) meeting of ad hoc groups (Chidambaram et al., 1990). Although it is difficult to pinpoint the developmental stage of a group at any specific time, the group development model at least implies that newly formed groups can show quite different behaviour patterns from mature ones. So, GDSS research results may be also affected by the stage of development of a group used in the study. In their laboratory GDSS experiment, Dennis et al. (1990) show that in general, there are differences between established and ad hoc groups. Established groups are less afraid to be openly critical of their peers or of being impolite. Group members do not participate equally in meetings: some people dominate the discussion. They talk more about how the process should go and make more uninhibited comments, thus producing a lower perceived task focus. In their assessment of existing empirical GDSS research, Pinsonneault and Kraemer (1989) argue that an automated support might have significant effects on groups at the early stages of development where group members try to establish and understand the norms of the group, try to define and defend their position, and try to obtain a basis of influence over the decision process, because it permits the members to focus more rapidly and intensely on the task itself, or, in other words, to arrive at a functional stage faster than those not supported. They, then, expect that the benefits of an automated support increasing



task-oriented communication and clarification efforts might be minimal at the more advanced stages of group development, when members have already focused on the task.

As we saw in the last chapter, however, the results of most field studies do not confirm this expectation. Although there were ad hoc groups in field GDSS research, which were specially formed to address a specific problem, but the vast majority of subjects in field GDSS studies knew each other very well and were used to working together in groups. In other words, they were at the mature stage of group development. But, most field studies have reported the very positive findings from the use of a GDSS compared to a conventional method. Specifically, Vogel and Nunamaker (1987) report that the GDSS can be used successfully both by mature groups where the members are familiar with each other and by groups specially formed to address a specific problem or question. More research is needed to better understand the impacts of the group development factor on the effectiveness of a GDSS in real organisation settings.

### **3.3.3. Norms**

Norms are rules of behaviour, proper ways of acting, which have been accepted as appropriate by members of a group. Given a set of goals, norms define the kind of behaviour which is (believed to be) necessary for or consistent with the realisation of those goals (Hare, 1976, p.19). Norms are usually not articulated spontaneously, but members can state them if asked to do so. Williams et al. (1975) maintain that the formation of group norms is the process, not of any one member's learning a norm, but of an entire group's developing and learning a norm together as a group. Norms, once developed, take on a kind of life of their own (McGrath, 1984, p.200). Norms belong to the group and not to the individual member (Fisher, 1981, p.185). Schein (1988) asserts that norms are very influential in determining member behaviour, perceptions, and feelings. In fact, some GDSS research indicates the impact of norms on their research findings. For example, Jarvenpaa et al. (1988) tested for differences in how each of the three software designer groups used the technology. They reported significant differences in performance and interaction measures among the groups, which were examined under identical technological supports. They found that the intensity of communication varied greatly from team to team, although the teams were of the same size (7 members). They also observed that differences in leader's attitude to encourage members to use technology had a significant effect on system usage. Zigurs et al. (1988) observed that the norms of one experimental group was

such that it chose not to use the GDSS during the experiment. Dennis et al. (1989) reported that group meetings can become more or less electronic, more or less conventional, depending on the preference of the subjects. Dennis et al. (1990) also showed the great deal of variance in the performance from the use of a GDSS between the established groups, compared to the ad hoc groups. They reckoned this variance as due to the differences in norms among the established groups. In the previous chapter, we saw that compared to the inconsistent findings in experimental GDSS research, real world users were consistently satisfied with GDSS use. The norms of experimental groups may simply be different from those of business groups.

A natural question to be raised here is that how GDSSs could influence group norms positively to enhance group performance and satisfaction. Group dynamics research maintains that norms are strongly influenced by a group's cohesiveness, that is, the more cohesive the group, the greater the conformity of members to group norms (Schermerhorn et al., 1985). Group cohesiveness is the degree to which members are attracted to one another and personally committed to the group (Fisher, 1981). In his extensive review of research on group cohesiveness, Shaw (1981, pp.215-226) concludes that relative to low-cohesive groups, high-cohesive groups engage in more social interaction, engage in more positive interactions (friendly, cooperative, democratic, etc.), exert greater influence over their members, are more effective in achieving goals they set for themselves, and have higher member satisfaction. A review of the literature also indicates reciprocal causal linkage between group cohesiveness and conflict management (Chidambaram et al., 1990). But the critical question is whether or not high-cohesive groups, as opposed to low-cohesive groups, show better group performance. Research argues that it all depends on the group's performance norm (Schermerhorn et al., 1985, p.293). Table III-6 below illustrates the performance levels predicted for various combinations of group cohesion and performance norms.

**Table III-6: Group cohesiveness, performance norms, and predicted levels of group performance**  
(from Schermerhorn et al. 1985, p.293)

Cohesiveness	Performance Norms	
	Positive	Negative
High	High performance	Low performance
Low	Moderate performance	Moderate to low performance

When the performance norm is positive, high conformity has a very beneficial effect; when the norm is negative, however, substantial undesirable results can occur when conformity is high. Between these two extremes are mixed situations. In both cases, the lack of cohesion fails to ensure member conformity to the guiding norm. Thus, the strength of the performance norm is substantially less and the level of outcome is somewhat moderate or low side.

Therefore, it becomes clear that a GDSS can be more helpful if it facilitates to heighten the level of group cohesiveness and at the same time to build positive work norms among participants. Group cohesiveness is affected by a variety of personal and situational variables (Shaw, 1981). Cohesion tends to be high in groups characterised by members who are homogeneous in terms of attitudes, socioeconomic backgrounds, needs, and other individual attributes. When members respect and hold one another's competences in high esteem, cohesiveness is also likely to be high. Situational factors that enhance group cohesion include agreement on group goals, small size, tasks requiring a high degree of interdependence, physical isolation from other groups (Schermerhorn et al., 1985). Group cohesiveness also varies with many aspects of the group process. For example, if a group leader provides both positive and negative feedback to group members about their behaviours, it is important that initial feedback be positive. When positive feedback is followed by negative feedback, cohesiveness is higher than when the negative feedback is given first (Schaible & Jacobs, 1975). Although a GDSS can not control personal variables, it can intervene some of the situational and group process variables to increase the level of group cohesiveness. A physical location of a meeting room can be designed to enhance group cohesiveness (Hickling, 1990). Many interpersonal-oriented group intervention techniques mentioned in the first chapter (e.g., communication instruction, Social Judgement Analysis) can also be used in GDSS settings to increase the level of group cohesion.

The other important function of a GDSS is to attempt to identify and reconstruct some of its performance norms and to test for itself whether the norms are helpful or constitute a barrier to effective action. Facilitators in a GDSS can do this by observing closely how critical incidents are handled and trying to infer the kinds of norms the group is building for itself. Having identified the norm, the facilitator can help the group to set about to change it explicitly to bring it into line with their feelings about how the group should operate (Schein, 1988, Vol.1 pp.76-83). Schein, for example, argues that one of the most destructive aspects of group behaviour comes about from lack of consensus. Here, valuable ideas and suggestions are suppressed because

members assume that they would not be accepted, leading sometimes to the group doing something that no one really wanted to do. Facilitators can employ several intervention techniques to increase the level of consensus among members (that is, to build positive group performance norms). For example, MAUA (Gardiner & Edwards, 1975) and SJA (Rohrbaugh, 1979;1981) have been shown to improve agreement among members.

### **3.3.4. Group Size**

Many group dynamics and GDSS research have reported that group size has an effect on interaction patterns among participants. For the purpose of this study, however, the opposing effects of size on group process are discussed at length in chapter 6.5.

### **3.4. GDSS Configurations: Multiple vs. Single Workstation**

As we reviewed before, the results from previous studies paint a mixed picture of the utility of meeting support technologies. Many researchers (Dennis et al., 1989; George, 1989) have explained the reasons for these mixed results by the differences in how technologies are used across a variety of settings and for tasks. All components of the GDSS environment have been shown to impact the process and outcomes of GDSS research. For example, the facility has an effect on the outcome of meetings (Mantei, 1989), hardware speed is important (Dennis et al., 1989), structured group work procedures show generally positive effects, the role of group facilitation is also crucial (Dennis et al., 1990; Phillips, 1986;1988), etc. Literature on the effects of computer-mediated communication also indicates that the use of technology will change group process. For example, it influences interpersonal relations, roles, organisational work, job performance, group productivity, and decision-making activities (Bikson, 1983; Chapanis, 1972; Christie, 1981; Hiltz & Turoff, 1981; Kiesler, 1986; Siegel et al., 1986; Turoff & Hiltz, 1982). So, it is natural to expect that different GDSS technologies can affect meeting outcomes and therefore research findings. In fact, investigations of GDSS technical environments demonstrate that even within a single GDSS category, decision rooms in this study, there are considerable variations across systems. This is because the developers of each GDSS have their own unique philosophies and visions about what a GDSS is and what it should do. GDSSs differ markedly each other in technical variables. The technical variables, here, refer to what features the GDSS provide, what activities those features support, and the extent of support they provide. Jarvenpaa et al. (1988) address the need of more research to be done to determine exactly what features of a GDSS provide the most effective and

efficient support for specific types of decision tasks. Although there are various feature variables which appear to be important in explaining the different research results, one variable which shows clearly the differences in researchers' philosophies as well as research results is whether the GDSS is equipped with a single workstation or multiple ones.

Decision Conferencing is an example of single workstation GDSSs, while the Plexsys system of University of Arizona exemplifies the multi workstation approaches. Comparisons of these systems are provided by Phillips (1988;1989b). For the purpose of this paper, however, descriptions of the differences between these two systems follow.

In multi workstation GDSS environments, participants are individually supported with technology which is interconnected to provide opportunities for electronic exchange and accumulation of information (Vogel & Nunamaker, 1990). Proponents of multi workstation GDSS assume that the most fundamental activity of the work of groups is interpersonal communication and the effectiveness of the work of groups is largely dependent upon equal participation of group members (DeSanctis & Gallupe, 1987; Vogel et al., 1987). The Arizona researchers also focus on larger groups (generally, 8 or more), where group members are rather collaborative (but not necessarily cooperative): e.g., for negotiation and in situations where hidden agendas exist or where certain members seem overly dominant and there is an unwillingness of members to publicly share certain information. While verbal communication is still possible with a large group, they argue that it is less effective; either the opportunity for equal participation of all group members is removed, or, if equal participation occurs, participants have far less time in which to communicate their ideas and opinions than they would in an equivalent small group meeting. This need to deal with larger collaborative groups should influence the design of a GDSS (Vogel & Nunamaker, 1990).

So, they assert that the primary goals of a GDSS are to make meetings more productive through improving group communication activities in terms of encouraging equality of participation and increasing the efficiency of that participation (Applegate, 1986; DeSanctis & Gallupe, 1987; Huber 1984; Nunamaker et al., 1989; Vogel et al., 1987). Then, they suggest that these goals can be achieved by providing an electronic communication channel for each group members, which enables participants to get equal participation, anonymous messaging function, impersonalised process, voting, efficiency of that participation by facilitating input from all group members in a

relatively simultaneous fashion; i.e., \*parallel processing (Dennis et al., 1988; Vogel et al., 1987; Vogel & Nunamaker, 1990). As group size increases, they (Nunamaker et al., 1989; Vogel et al., 1987) found that the group efficiency, effectiveness, and satisfaction were enhanced by the parallel processing method. But, they (Nunamaker et al., 1988) report that small groups (up to 5) were more frustrated by the system constraints of the various software tools. For small groups, the Plexsys system of University of Arizona was reported not more effective or efficient than a conventional face-to-face meeting.

The decision conferencing researchers assume that the nature of work of groups is mostly to create and explore options, to formulate preferences, to generate judgements and to produce plausible options for the leader to take decisions (Phillips & Phillips, 1991). So, the goals of a decision conference are generation of plausible perspectives about the problem, shared understanding, production of convincing options for the leader, and, when desirable and necessary, commitment to action. Phillips (1986; 1988; 1989a; 1989b) argues that these goals can be achieved by (1)\*\*equity of participation rather than by equality of participation, (2) effective group interaction guided by a certain "language" and "grammar" (modelling activity based on decision analysis) rather than by just improving interpersonal communication through the use of parallelised individual messaging, (3) consensus reaching through interaction rather than by simple pooling of individual messages and resorting to voting, and etc. Here, the model represents the participants' conception about the problem domain which is described by its variables in terms of objects, defined relationships and the attributes carried by those objects and relationships. Increased understanding of the cause-effect relationships among these significant variables of the problem leads to the group generating and choosing better solutions (Loy et al., 1987).

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**\*Parallel processing:** The methodology is designed so that all participants can enter comments at the same time. Members need not "wait their turn" to contribute to the question or problem before the group. The methods determine the order in which comments will be displayed. While parallel processing is often more efficient, depending on the number of participants, the number and complexity of the comments may soon become overwhelming unless appropriate measures are taken to manage the process. Anonymity may be important to draw out true feelings, voting is commonplace, and support for a facilitator as well as participants is likely to exist (Dennis et al., 1988, p.604).

**\*\* Equity of participation:** the congruence between the proportion of the group's time used when a member speaks and the contribution of that members to the group task (Fisher, 1981).

As Phillips (1987) argues

a unique feature of decision conference is the on-the-spot creation of a computer-based model that incorporates the differing perspectives of the participants in the group. By examining the implications of the model, then changing it and trying out different assumptions, participants develop a shared understanding of the problem and are helped to reach agreement about what to do. The model developed in a decision conference lends structure to thinking, and allows all perspectives on a problem to be represented and discussed. This helps to take the heat out of arguments that arise from differences in perspective, facilitate communication, provide a "way to talk differently", as one person put it, and reveal differing assumptions. Because the model developed by the group shows what the organisation can do, rather than describe what it does do, creative and lateral thinking is encouraged (Phillips, 1987, pp.108).

Therefore, the model developed in a decision conference provides a mechanism for improving group discussion by letting group members focus their discussion on the critical aspects of various alternatives, and to define thought processes in order to provide numerical inputs to the model. The direction of the discussion toward aspects of the model also tends to depersonalise the decision making process, and to result in recommendations that are not only more than often mutually acceptable to all group members, but more strongly supported by them (Adelman, 1984). As far as communication channels are concerned, McCartt & Rohrbaugh (1989) argue that verbal and nonverbal communication in decision conferences is not restricted by electronic networking but, rather, takes a completely connected, "each to all" pattern enhanced by the presence of a group facilitator.

The other basic, different assumption of these developers is that while the former believes previous experience or skill of computer (keyboarding) has little to do with actual GDSS use, the latter believes executives do not like to type and some people shun unfamiliar technology.

In brief, the Plexsys system at the University of Arizona is multi workstation, computer-based and meeting support-oriented, and provides a workbench environment where the main communication channel is electronic. Its main purposes are to encourage even participation and increase the efficiency of that participation through improving interpersonal communication activities. Decision conferencing is people-centred, modelling-oriented, and provides a low-tech, problem-solving environment where the main communication channel is verbal.

Independent of such big differences between these two approaches, both are now successfully operated at several universities and companies in the UK and USA. It might mean that one approach has strong as well as weak points against the other. Therefore, the following comparisons may suggest to system developers possible points for improving their own systems.

#### **3.4.1. An electronic communication channel**

A GDSS assists the group work process by providing an additional communication channel via the computer system, and/or by adding structure (DeSanctis & Gallupe, 1987). As we mentioned earlier, one of the fundamental assumptions of proponents of multi workstation designs is that group performance and satisfaction can be most improved by enhancing interpersonal communication which enables group members to participate equally (DeSanctis & Dickson, 1987; Vogel et al., 1987). So, they argue that GDSS should encourage even participation in group decision-making (Applegate et al., 1986; DeSanctis & Gallupe, 1987; Huber, 1984). To do that, their GDSSs provide electronic communication channels via the computer system, which includes several features such as anonymous input methods, roll calling for votes, or solicitation by the system for input of ideas by all members in a simultaneous manner. Much of the literature on multi workstation GDSS rests on the assumption that the addition (or substitution) of an electronic channel of communication for verbal information exchange will promote more equal participation, increase access to meeting information, and lead to better decisions and other outcomes, and to higher productivity (DeSanctis & Gallupe, 1987; Huber, 1984; Watson et al., 1988; Zigurs et al., 1988).

In fact, an electronic communication channel enables parallel processing of information, and anonymous messaging function, and at the same time requires user keyboarding. Blending these 3 components in a multi workstation GDSS may yield both positive and negative effects on group performance and other outcomes compared to a single workstation GDSS with verbal communication between participants. In fact, Kiesler (1986) points out the addition of an electronic medium for interpersonal communication can bring about some negative as well as positive effects. For instance, Zigurs et al. (1988) point to the importance of communication channels during group discussion, because those are mechanisms for influence. They argue that in multi workstation GDSS environments group members start their "group life" as equals, in the sense that they have equal access to electronic communication channels. The electronic communication channel is easily available, and its anonymity



should represent a low threat form of communication, providing an opportunity for expression of ideas and arguments that would otherwise not exist. It encourages individuals who would not otherwise assert themselves through certain channels such as verbal, to do so through the electronic channel, thus enhancing equal participation through evening out what might have been unbalanced prominence in a group. In fact, Siegel et al. (1986) report that groups using computer-mediated communication, when compared with face-to-face groups, participate more equally within the group. However, as Zigurs et al. (1988) add, over time a differential pattern of actual communication channel use may develop, given different preferences or skill levels with respect to channel use. For example, in multi workstation GDSS environments one person may be more skilful in keyboarding than another. If so, there may be new forms of status influence that arise because of the difference of that skill level, although one of the primary purposes of multi workstation GDSS is to encourage equality of participation.

### **3.4.2. Three features of a multi workstation-based GDSS and their effects**

Next, we will look at three main features of a multi workstation GDSS: parallel processing of information, anonymous messaging function, and required user keyboarding and reading screen. Then, we shall examine the intended as well as unintended effects of these three features on group performance and other outcome measures.

#### **(1) Parallel processing**

The methodology is designed so that all participants can enter comments at the same time. Members need not "wait their turn" to contribute to the question or problem before the group. The method determines the order in which comments will be displayed (Dennis et al., 1988; Vogel & Nunamaker, 1990). Arizona researchers claim that meeting productivity and the efficiency of the equal participation can be remarkably enhanced due to the parallel processing approach. For example, Nunamaker et al. (1989) report that 55% of time saving (in terms of project duration, number of meetings, and person-hours) has been achieved with the use of a GDSS at IBM sites, mainly due to the parallel processing characteristics of electronic communication channel.

#### **(2) Anonymity**

The multi workstation technology enables the team members to submit ideas to others anonymously. Anonymity is regarded as one of the most advantageous features of multi workstation GDSS environments.

i) Invoking a sense of equality and encouraging participation by all members

Anonymity is believed to be a positive factor in encouraging broad-based participation (Lewis, 1982; Siegel et al., 1986). For groups of differing organisational levels, it provides a sense of equality and encouragement for participation by all members in the group independent of perceived status (Nunamaker et al., 1988; Vogel & Nunamaker, 1987;1990). So, it reduces the probability of any one member dominating the meeting (Turoff & Hiltz, 1982).

ii) Greater objectivity of ideas (detaching personalities from the ideas)

Anonymity is important to groups when sensitive issues are being discussed that can easily be confounded with personalities in the group (Vogel & Nunamaker, 1987; 1990). If ideas and preferences are exchanged anonymously, individual members will not know who favours what, or where specific members stand on an issue. Therefore, external characteristics such as status, authority, and roles of the group members are disassociated from the ideas through anonymity so that each comment is evaluated on its own merits rather than being evaluated in light of the person who made the comment (Gallupe et al., 1988; Nunamaker et al., 1987; Zigurs et al., 1988). While allowing for more objective evaluation of the alternatives without the necessity of possibly defending previously stated postures, this will also prevent members with high perceived power from exercising influence (DeSanctis & Gallupe, 1987; Gallupe et al., 1988). This again leads to more effective use of time and generation of more alternatives (Gallupe et al., 1988; Nunamaker et al., 1988; Vogel & Nunamaker, 1987). It also brings out more honest ideas without emotional content, because the anonymity of the input allows participants to change positions on an issue without embarrassment (Nunamaker et al., 1989). Problems of "group think", pressures for conformity, and dominance of the group by strong personalities or particularly forceful speakers are minimised (Nunamaker et al., 1988; Vogel & Nunamaker, 1987), and participants may feel more free and be able to think more creatively (Jelassi & Beauclair, 1987). In practice, Jessup et al. (1987) found that the anonymous conditions of a GDSS acted as a buffer between group members, detaching them from their comments, thus enabling them to be critical of each other in a non-threatening way. Subjects in their experiment reported that they liked the system because they felt criticism was addressed at ideas and not to them personally.

This impersonalised effect of anonymity can also be found in the electronic communication medium itself. Vogel & Nunamaker (1990) report that the ability to consider the comments of others through a screen interface is less volatile than face-to-face encounters, is less threatening, and promotes a higher sense of appreciation for multiple perspectives. Boje & Murningham (1982) suggest that the loss of social cues due to electronic communication can be expected to encourage open input of creative ideas, discovery of optimal solutions, and selection of an alternative based on its merits rather than on compromise. Siegel et al. (1986) also argue that the reduction of social cues in computer-mediated communication should reduce the impact of implicit reference group norms and of group members' social approval of one another, and increase the importance of arguments or decision proposals. Furthermore, Rutter & Robinson (1981) argue that even if names are attached to ideas, ideas will still tend to receive greater attention than proponents when communication is electronically based.

### iii) More comments generated

In their multi workstation GDSS experiments, Connolly et al. (1988) and Jessup et al. (1987; 1988) examined the effects of anonymity of an EBS (electronic brainstorming) tool on group process and outcome. They found that anonymity in sending and receiving comments generated significantly more total comments, as well as more critical comments. Group members under anonymous conditions tended to be more probing and critical of each other's ideas and that these actions generated more comments (Jessup et al., 1987). Turoff & Hiltz (1982) also reported that the anonymity of electronic communication increased the number of interpersonal exchanges.

### **(3) Access to the system (keyboarding and reading screen)**

Who interfaces with the system is the important factor for the design of a GDSS. The single workstation designers believe executives do not like to type and some people shun unfamiliar technology. So, forced access to the technology can cause cognitive overload and psychological tension to members, which adversely affects group deliberations. In multi workstation GDSS approaches, the Claremont (formerly SMU room) room (Gray et al., 1981; Gray & Olfman, 1989) is also based on the assumption that most executives do not type or do not like to type. Therefore, the terminals at the tables are touch screens and are menu driven.

However, Minnesota (Gallupe et al., 1988) and Arizona (Nunamaker et al., 1989; Vogel & Nunamaker, 1990) rooms are based on the assumption that previous experience or skill of keyboarding has little to do with actual GDSS usage.

They claim that using the keyboard as an input device is much less an inhibitor of active participation than initially hypothesized (Nunamaker et al., 1988; Vogel & Nunamaker, 1990) and previous experience with computers or keyboard familiarity has little to do with actual GDSS usage (Gallupe et al., 1988). They argue that the reason for avoidance of computers may be more a matter of lack of recognition of any benefit of use. In the case of a GDSS, appreciation of group effectiveness and efficiency as well as focus on idea generation rather than typing skills tends to foster use of keyboards by users who otherwise would abstain (Vogel et al., 1987).

The possible benefit from keyboarding is that it helps participants think again prior to entering data. Unlike a verbal interaction, in which oral communication flows rather naturally, participants must transfer their thought through a physical medium, thus creating one more step at which he/she must reflect on the situation and his/her role in it (Jelassi & Beauclair, 1987).

Although these positive claims about the effects of parallel processing of information, anonymous messaging function, and required user access to the system may engender enthusiasm to multi workstation-based GDSSs, researchers have observed some undesirable or problematic effects as well.

### **3.4.3. Unintended Consequences**

#### **(1) User access to the system (--- > heightening meeting time?)**

Jarvenpaa et al. (1988) argued that some of the communication effectiveness and efficiency gained by the use of the computer-based technology might be lost due to the time spent typing and reading messages on the workstation screens. Because team members had to spend more time focused on their computer screens and keyboards, they spoke less. The time spent typing also possibly reduced the time spent listening. The inability to listen, then, might have additionally reduced the number of verbal remarks and electronic messages exchanged. Kiesler (1986) also pointed out that the use of keyboard input and the greater volume information flow could add to the level of effort required in a group meeting, thus lowering group efficiency. Similarly, Siegel et al. (1986) found that group members made fewer remarks: typing and reading are physically more difficult and time consuming than are speaking and listening. They

found that typing might have accounted for about 40% of the differences in the number of remarks between face-to-face and computer-mediated communication. They added that computer-mediated communication group took longer to make their group decisions due to time spent typing and reading.

The other possible negative effect in typing is that, although it may help participants reflect on situations and their role in it once more, it can constrain participants' intuition and creative thought about the problem. Usually, intuition comes and disappears suddenly. But, typing is slower and more difficult than speaking. So, intuitive and creative ideas can be easily lost by the cognitive overload and time taken in typing.

Now, we have two contradicting features and arguments about the efficiency of multi workstation-based GDSSs: one is that meeting time can be reduced by the parallel processing, and the other is that it can be increased by the required user typing and screen reading. Which one can outweigh another? While some researchers (Dennis et al., 1988) argue that the benefits of the technology appear to far outweigh the problems caused by the technology, others (Kiesler, 1986) point out that the unanticipated negative effects may counteract or wash out the gains realised from a GDSS.

As we can see from table III-7, previous multi workstation-based decision room type GDSS research also show the inconclusive results. There is no one study in the nine existing multi workstation GDSS laboratory experiments to report shortened meeting time from the use of the technology compared to manually structured or natural meetings (see table III-7 in next page). The use of multi workstation-based GDSS compared to manual structured process has been shown to increase time required to make a decision (Gallupe et al., 1988; Gallupe & McKeen, 1990; Lewis, 1982; Steeb & Johnston, 1981) or to have no effect on time required (Easton et al., 1989; Watson, 1987). The use of a multi workstation-based GDSS compared to no support at all has been shown to increase time required to reach a decision (Easton, G., 1988; Easton et al., 1989; Lewis, 1982; Watson, 1987) or to have no effect on time required (Gallupe, 1986; George et al., 1988). While one study (Lewis, 1982) found multi workstation-based GDSS took more time than both manually structured and no support process, two other studies (Easton et al., 1989; Watson, 1987) found no time difference between GDSS and manual structured support, but structured support groups took longer than no support groups. While Gallupe (1986) found that multi workstation GDSS groups took more time than no support groups independent of task difficulty,

Bui and Sivasankaran (1990) reported that multi workstation GDSS groups compared to manual structured groups took longer with low difficulty tasks, and took the same time with high difficulty tasks.

However, most research results from case and field studies show that participants enjoy efficiency from the use of a multi workstation GDSS compared to a similar conventional meeting. For example, Nunamaker et al. (1989) report that 55% of time saving (in terms of project duration, number of meetings, and person-hours) has been achieved with the use of GDSS at IBM sites.

Enhanced efficiency from the use of a GDSS in field settings has been consistently reported by single workstation-based GDSS research as well. For example, Phillips (1989a) notes that agreement is reached much more quickly with the use of a GDSS (here, Decision Conferencing) than could be achieved by a conventional procedure.

**Table III-7: Decision time taken in multi workstation-based GDSS environments (decision room type)**

	Decision time
<b>&lt; Lab Experiment &gt;</b>	
Steeb & Johnston (1981)	GDSS took longer than MSS
Lewis (1982)	GDSS took longer than MS, NS
Gallupe (1986)	No difference between GDSS and NS
Watson (1987)	(GDSS=MS) took longer than NS
Gallupe et al. (1988)	GDSS took longer than MSS
Gallupe & McKeen (1990)	GDSS took longer than MSS
Easton G. (1988)	GDSS took longer than NS
George et al. (1988)	No difference between GDSS and NS
Easton et al. (1989)	(GDSS=MS) took longer than NS
<b>&lt; Field, anecdotal evidence &gt;</b>	
Nunamaker et al. (1989)	GDSS more efficient (55% time saving)
Vogel & Nunamaker (1990)	GDSS more efficient
Dennis et al. (1990)	GDSS more efficient

\* MS: manual structured process (same degree of structure with GDSS)

MSS: manual semi-structured process (loosened structure than GDSS)

NS: no structured support at all

## **(2) Loss of context**

Jarvenpaa et al. (1988) reported that the members, and particularly the leaders, found the anonymous nature of the messages irritating, as they could not always put the message in the context of the group discussion. Kiesler (1986) also reported the anonymous nature in electronic media of communication resulted in a loss of social context cues, which resulted in more negative, or "flaming" communication among members. DeSanctis and Gallupe (1987) argue that some critical political information that is often obtained in meetings will be lost when GDSS technology is introduced. Acquiring and maintaining power has some positive valence to all individuals, and meetings are a forum for achieving and maintaining power in organisations. If a leader of the meeting felt his/her power undermined from the use of a GDSS (here, anonymity, electronic communication channel), he/she would not be willing to accept the outcomes of the meeting, and never convene a GDSS supported meetings again. Vogel and Nunamaker (1987; 1990) also mention that, in any written medium, richness of voice inflections and facial expressions is lost which can lead to misunderstanding. Occasional face-to-face discussions focused around front screen displays as well as breaks and social time are definitely important complements to individual workstation interaction as issues become more politically charged and sensitive.

## **(3) Participation**

It must be right that the enhanced equality of participation and increased efficiency of that participation through using the electronic communication method may have some advantages over natural (unsupported) group work. For example, Turoff and Hiltz (1982) have found the anonymity of electronic communication to increase the number of interpersonal exchanges and reduce the probability of any one member dominating the meeting. Kull (1982) report that by giving each participant an assured input in the decision process, domination by one or two individuals is minimised. Steeb and Johnston (1981) report that each group member experiences equal participation in the decision process through individual computer-entry of required probability and utility values. Siegel et al. (1986) report that a GDSS (here, an electronic communication with individual workstations) provides a framework within which group members who are reluctant to contribute are encouraged to participate (heightened "social equalisation") and potentially influence the group discussion. So, a GDSS will result in a more democratic decision process, with more equal participation among members.

## **Is the equal participation really desirable for group meetings?**

Full and egalitarian participation by all group members is generally considered desirable to ensure complete information exchange and promote error checking, thus allowing better decision-making possible, at least in tasks where such exchange is desirable (Hackman & Kaplan, 1974; Holloman & Hendrick, 1972; Janis & Mann, 1977). Group dynamics research also suggests that greater member participation should increase acceptance and a sense of responsibility for a decision (Bedau, 1984; Hackman & Kaplan, 1974), as well as greater cohesiveness and satisfaction with the group (Hare, 1976).

In short, greater member participation is believed to bring two major benefits: one is the better quality of outcome, and the other is the increased satisfaction of members and the acceptance of the outcomes.

Here, we need to note carefully the differences in the nature of full participation between group dynamics researchers mentioned above and multi workstation-based GDSS proponents.

The nature of full participation of group dynamics research is based on substantive discussion or extensive group interaction. In fact, some of them (Fisher, 1981; Zander, 1982) suggest that quality of team performance is believed to be associated with equity as well as equality of participation. However, multi workstation GDSS research places a positive value on equality of participation, irrespective of differences in members' stratum, cognitive capacity, knowledge, power, and etc. Their major concern is to improve equality of participation and the efficiency of that participation by providing electronic communication to all group members. For example, DeSanctis and Gallupe (1987) argue that to the extent that GDSS technology encourages equality of participation and discourages dominance by an individual member or subgroup, perceived member power and influence should become more distributed and decision quality should improve.

This method, however, while allowing each individual to send and receive messages in an uninterrupted and simultaneous manner, can actually preclude members from interacting each other, and ignores member differences. In fact, Kiesler (1986) point out that unintended problems might arise when natural patterns of participation are altered by technology (the addition of an electronic medium for interpersonal communication).



Recently, two GDSS studies (Gallupe, 1990; Zigurs et al., 1988) described below examined the effects of equal participation on group performance (decision quality). Both studies have shown that the enhanced even participation from the use of electronic communication channel does not necessarily bring improved decision quality. Zigurs et al. (1988) compared the performance of two natural (no support) groups: Group "A" was an essentially egalitarian group with simple pooling of individual opinions but without substantive discussion or extensive group interaction., Group "B" was a greater interaction group with its uneven participation. They found that the Group "A" was able to improve group over individual performance by simple pooling of individual opinions. However, group "B" was able to improve performance more than group "A". Similar results were observed in a GDSS setting too. They found that even if computer support helped to even out individual influence behaviour, it did not result in higher quality decisions than were made in manual groups. They, then, concluded that equal exercise of influence (that is, degree of participation) did not necessarily enhance performance, although it may have had other beneficial group effects. In his recent laboratory experiment, Gallupe (1990) found that best members significantly outperformed the GDSS groups, and the best members of the group did not do as well in GDSS supported groups compared with non-GDSS supported groups. He explained that the so-called advantages of GDSS use, more democratic participation and anonymity, served to decrease the ability of the group's best member to get their solution recognised; that is, the GDSS facilitates communication for everyone in the group and not just the best member. He suggested that the system, while facilitating participation by all group members, created an environment where the best member solution was not adopted by the group. So, the performance of GDSS supported groups was lower than that of non-GDSS supported groups.

Both studies clearly show us that just enhancing the equality of participation without considering the members' differences can undermine group's performance. Gallupe's (1990) study shows that the enhanced satisfaction of "ordinary" members was incurred at the cost of the best solution, because the "best-member's" solution was rejected by the "ordinary" group members. In a real world setting, if the "best member" is the most senior member of a group, then a less-than-most effective managerial decision will be made. In real world organisations which usually have accountability hierarchies, it is individual managers who are given authority to commit resources and it is individual managers who are held accountable for the deployment of the resources (Phillips & Phillips, 1991); a group decision which places an emphasis on the equality of participation, may not yield best decisions.

Extensive face-to-face interaction guided by a certain structured process, true equality of participation which respects members' differences may be more effective in improving group performance, and more importantly in enhancing the implementation of the decision than equality of participation through individual messaging and simple pooling of individual opinions by way of electronic communication channel provided to all group members, which does not concern the difference in members' stratum, cognitive capacity, knowledge, power, and etc.

#### **(4) Increased cognitive overload and psychological tension**

As we saw before, one of the distinctive advantages of using a multi workstation is to enhance equality of participation among group members and to increase the efficiency of that participation, especially with the increase in group size. So, Vogel et al. (1988) interpret the results of two experimental studies (Gallupe, 1986; Watson, 1987) that reported no change in participation, due to the small group size (3 or 4) employed in their studies where there was less opportunity for the use of a GDSS to increase participation. However, even with the larger group size of seven, Jarvenpaa et al. (1988) reported that there was little difference between multi workstation supported groups and natural (no support) groups in the degree of equality and perceived equity of participation. They explained this unexpected finding due to the apparent cognitive overload, and reduced listening capability in the multi workstation meetings compared to no support or electronic blackboard meetings. They added that those cognitive overload and reduced listening capabilities might have overridden the possible benefits of a multi workstation technology.

The participants in the workstation meetings had to use a keyboard to take notes on their respective notepads, scan their workstation screens for messages, and attend to the flipchart in the front of the room, in addition to engaging in verbal discussions. Further, the group leader had to act upon the messages sent to his screen. During the debriefing session, many participants complained that the multiplicity of messages and information in the workstation meetings made it difficult to keep up with the meeting's progress. Thus, it seems that the workstation technology used was so demanding that it inhibited verbal communication. (Jarvenpaa et al., 1988, pp.657-658).

Similarly, Kiesler (1986) suggests that the use of keyboard input and the greater volume information flow from the addition of an electronic medium for interpersonal communication can add to the level of effort required in a group meeting, thus lowering group efficiency.

These findings tell us that a GDSS (here multi workstation) can be counter-productive if the technology does not balance the need for alternative communication channels with the participants' ability to manage multiple channels. We need to note that, in Jarvenpaa et al.'s study (1988), users felt difficulty in adopting the multi workstation technology to their decision making process, even though it was a chauffeur-assisted GDSS, and users themselves were very experienced computer software designers. Other researchers (DeSanctis & Gallupe, 1987; Kull, 1982; Nemeth, 1982) also report that assured input features such as roll calling for votes or solicitation by the system for input of ideas by all members will pressure those who otherwise might be passive in the group to take an active role, perhaps increasing psychological tension in the group, although it can reduce the domination of one or two individuals.

#### **(5) Increased conflict (More difficulty in reaching consensus)**

Previous anecdotal evidence of a multi workstation-based GDSS (Nunamaker et al., 1987; Vogel et al., 1987;1988) as well as experimental studies (Applegate et al., 1986; Gallupe, 1985; Gallupe et al., 1988; Siegel et al., 1986; Watson et al., 1988) consistently report increased conflict from the use of the technology. However, case studies and anecdotal evidence of a single workstation-based GDSS (mainly, Decision Conferencing) show consistently the enhanced consensus from the use of the technology (Adelman, 1984; Phillips, 1985;1987; Volpato, 1990; Weiss & Zwahlen 1982).

Why is the conflict reported to be heightened particularly in multi workstation-based GDSS environments?

##### i) More aggressive communication

The anonymity function inherent in multi workstation-based GDSS does tend to heighten conflict within the group as members tend to become more blunt and assertive in their comments. Members tend to express themselves more forcefully and are often not as polite when interfacing through the system rather than in person [Jarvenpaa et al., 1988; Nunamaker et al., 1988; Vogel & Nunamaker, 1987; Watson et al., 1988). Kiesler (1986) and Siegel et al. (1986) also suggest that the electronic medium of communication results in a loss of social context cues, which results in more uninhibited behaviour- strong and inflammatory communication among members.

### ii) Multiple viewpoints and greater objectivity of comments

Gallupe et al. (1988) argue that GDSSs (here, individual terminal and public screen) disassociate participants from the alternatives they entered into the system. This enhances idea generation and heightens the group's awareness of multiple viewpoints. The results are (1) more alternatives in more objective evaluation in more detail, without the necessity of possibly defending previously stated postures, then (2) higher level of conflict, less agreement with the final decision, and less satisfaction with the decision process. This "richer" support to examine more alternatives in more detail has more conflicting views to be aired. Similarly, Kiesler (1986) also points out that heightened awareness of member's viewpoints and greater objectivity in reviewing proposed ideas or solutions to a problem through anonymity of the message may raise the level of conflict in the group. In their study of the effect of GDSS on choice shift, Gallupe and McKeen (1990) report that in face-to-face settings the GDSS tended to even out participation in the group deliberations and the persuasive impact seemed to be minimal and hence less choice shift from individual values to group choice was observed (so, less possible consensus). Turoff and Hiltz (1982) and Gallupe (1985) also report that added participation through the use of electronic communication channels makes consensus more difficult to achieve. This fact may make participants in a multi workstation GDSS environment more reliant on the voting method rather than consensus reaching through group interaction.

### iii) Increased social distance

DeSanctis and Gallupe (1987) argue that the electronic communication component within a GDSS will influence perceived physical distance among members which, in turn, will affect interpersonal attraction and group cohesion. Monge et al. (1985) argue that perceived physical distance is more critical to group behaviour than actual physical distance. The opportunity and obligation for communication that people perceive by being physically close or distant impacts the nature of their interpersonal exchange and feelings of cohesiveness.

Group cohesiveness may be irrelevant if decision quality is the primary objective of the group; however, the variable becomes extremely important if strong morale, long term cooperation and conformity to group norms are critical to the organisation (Hollander, 1964; Shaw, 1981). DeSanctis and Gallupe (1987) expect that in face-to-face meetings the GDSS should increase perceived distance as electronic communication is substituted for at least some direct verbal communication. In practice, Watson et al. (1988) reported that the heightened interaction through the

electronic medium, coupled with greater human-computer interaction relative to human-human interaction, seemed to increase the sense of distance among members.

Group members appeared to interface more with the system than each other. Rather than consisting of continuous verbal exchange, the meeting had periods of quiet time spent by the group members as they read screens or entered text or data into the system in the midst of verbal discussion. And they frequently faced the large public screen while talking to one another (Watson et al., 1988 p.475).

Kull (1982) also found that the use of electronic media (here, public display and multi workstation) reduced the social cues and social interaction of a meeting, therefore increased conflicts. In summary, they thought that use of a GDSS (here multi workstation, public screen) tend to:

- heighten human-computer interaction --->
- reduce eye contact and human-human interaction --->
- increase social distance among members --->
- increase aggressive communication, conflict, and
- decrease the quality of group discussion, consensus.

Although Shaw (1981) argues that some conflict is necessary for effective group decision-making, this heightened conflict from the use of electronic communication channels can be seriously problematic in organisational settings where group meetings are used to gain consensus and acceptance of ideas, rather than to gain high quality decisions.

#### **(6) Deindividuation and diffusion of responsibility**

Anonymity may enhance the negative impact that deindividuation has on group decision-making. For example, the loss of the sense of objective self-awareness caused by anonymity may lead the group to behave in irrational ways, generally to greater risk taking (Jelassi & Beauclair, 1987). Also, it may enhance diffusion of responsibility for their meeting results. Therefore, participants rarely feel responsible for the implementations of meeting outcomes.

## **(7) Other technical problems in multi workstation-based GDSS**

### i) Limited view of the problem to computer screen size

In multi workstation GDSS environments, users should read the screen to gain access to other group members' ideas. Siegel et al. (1986) postulate that inefficiency results from the increased difficulty in typing and reading as a communication mode when compared with speaking and listening. They report that time spent reading the screen during the sessions took 27% of the total session time. Furthermore, Nunamaker et al. (1987) report that in a multi workstation GDSS environment the view of the task was limited by the size of the computer screen. Even though the software allowed the user to scroll through the comments, group members had difficulty in categorising critical issues and developing rankings. They appeared to have lost the "world view". They argue that an important dimension of the consensus development process is that the group members must be able to view the entire problem and not be limited by the view of the problem provided by a computer screen. So, they suggest that the "world view" of the problem can be provided by being able to spread all of the pages of ideas out in front of them or being able to hang up multiple flip chart pages of ideas around the room.

### ii) Asynchronous quality of electronic communication

This is the interval of time between the moment when a participant sends a screen and the moment when a new screen is received. This asynchronous quality of electronic communication has been observed to affect group work negatively (Dennis et al., 1988; Watson et al., 1988). Dennis et al. (1988) report that users expect to receive on-the-spot response for all activities.

### iii) Expenses

The cost for establishing and running a multi workstation-based GDSS is far more expensive than that of single workstation GDSS. For example, it takes \$2,000,000 to build Arizona's large multi workstation-based room, whereas \$150,000 is required to build a Pod (single workstation-based room) at L.S.E. Concerning softwares, Arizona asks \$5,000 for the initial license fee and \$2,500 for the annual maintenance fee for research institute, but L.S.E. charges \$2,000 for their HIVIEW, and EQUITY (\$1,000 for each one) for commercial, research and other purposes.

#### 3.4.4. Conclusion

An electronic communication channel inherent in multi workstation-based GDSS has been observed to have some negative as well as positive effects on group performance and other outcome measures. While some researchers (Dennis et al., 1988) argue that the benefits of the technology appear to far outweigh the problem caused by the technology, others (Kiesler, 1986) point out that the unanticipated negative effects may counteract or wash out the gains realised from a GDSS.

The following is a summary of both effects.

##### \* Positive effects

- (1) Meeting productivity and the efficiency of equal participation can be enhanced by parallel processing approach.
- (2) A sense of equality and even participation by all members may be encouraged by anonymity.
- (3) Multiple viewpoints and greater objectivity of ideas may be generated by anonymity and electronic communication medium, because they detach personalities from the ideas.
- (4) Anonymity tends to generate more comments.
- (5) Previous experience or skill of typing has little to do with actual GDSS use, and typing helps group members take one more step at which he or she must reflect on the situation and his or her role in it.

##### \* Negative effects

- (1) Group efficiency is reported to be reduced due to the time spent typing and reading the screen.
- (2) The cognitive overload and time spent typing and reading the screen can adversely affect participants' intuition and creative ideas about the problem.
- (3) Anonymous nature in electronic communication channel can result in a loss of social context cues, which result in a loss of some critical political information.
- (4) Richness of voice inflections and facial expressions can be lost, which can lead to misunderstanding.
- (5) Enhanced even participation from the use of electronic communication channel does not necessarily bring improved decision quality: democratic participation and anonymity tend to decrease the ability of the group's best member to get their solution recognised.
- (6) The required use of the technology may cause cognitive overload or psychological tension to participants. Much evidence exist that a multi workstation GDSS can be

counter-productive if the technology does not balance the need for alternative communication channels with the participants' ability to manage multiple channels.

(7) There may be new forms of status emerging because of the dominance of electronic communication channels by members who are more computer literate including keyboarding, although one of the primary purposes of a multi workstation GDSS is to discourage dominance of communication channels by talkative or higher status members.

(8) Anonymous nature of multi workstation GDSSs does tend to heighten conflict within the group as members tend to become more blunt and aggressive in their comments.

(9) Heightened awareness and objectivity of members' viewpoints and greater even participation through the use of anonymous nature in electronic communication channels may raise the level of conflict in the group.

(10) The electronic communication component in multi workstation GDSSs seems to increase the perceived physical distance among members, which, in turn, affects negatively interpersonal attraction and group cohesion.

(11) Anonymity may enhance diffusion of responsibility among members.

(12) In multi workstation-based GDSSs, users must read the individual screen to gain access to other group members' ideas. It means the view of the problem is usually limited by the size of the computer screen. People appear to have lost the "world view" which is so important to the consensus development process.

(13) Usually, the cost for establishing and running a multi workstation-based GDSS is far expensive than that of a single workstation GDSS.

This summary of the positive and negative effects of a multi workstation-based GDSS has led us to tentatively conclude that the heavy investments in multi workstation-based GDSS may be ill-conceived.

However, what circumstances make a multi workstation-based GDSS more desirable than a single workstation GDSS is a research issue that needs to be investigated more in the future. In the meantime, DeSanctis and Gallupe (1987) suggest that electronic communication channels are suitable where creative solutions to a known problem must be generated. Here individuals work better alone than together since social comparison processes tend to inhibit creativity and development of quality solutions (Hare, 1976; Van de Ven & Delbecq, 1974). Decision support technology here can be used to pool, organise and feed back ideas collected from individuals. On the other hand, Arizona researchers argue that it is much more productive to support larger groups (8 or above). As Jarvenpaa et al. (1988) pointed out, however, it may have its



greatest value in supporting groups distributed in space or time (but not in face-to-face situations).

### **3.5. Measures Employed**

A caveat also exists in terms of degree of experimental rigour, measurement sophistication, and accountability for confounding effects of the variables (Vogel et al., 1990). Different research design and noncomparability of measures across GDSS studies may also yield different research results.

## CHAPTER 4. THEORETICAL BASES FOR THE DESIGN OF QUESTIONNAIRE

The theoretical basic framework for describing and evaluating the effectiveness of decision-making with a GDSS (here, Decision Conferencing) will be Competing Values Approach (CVA) to organisational analysis (Lewin & Minton, 1986; Quinn & Rohrbaugh, 1981;1983). The questionnaire primarily based on the CVA framework serves as the basis for the instrumentation to test the participants' perceived effectiveness of the decision processes with decision conferencing. Measures were based upon the decision conference participants' self-report of perceptions on decision processes, rather than on expert evaluations of the quality of decisions or the quality of deliberations. The reasons are:

(1) While the use of self-report measures is generally regarded as inferior to direct observation of behaviour, construct reliability and validity are usually higher for self-report instruments than for interpretive coding schemes, and the data is less costly to collect (Zigurs et al., 1989).

(2) In "real world" settings, there are usually no right or wrong answers. In fact, most higher level organisational meetings occur without prior or post knowledge of the "correct" outcome of a group meeting. And, subjects themselves are the specialists in their organisation's business. No one can know it as well as they do. Therefore, it is almost impossible for anyone else to evaluate formally the quality of those specialists' decisions.

McCartt and Rohrbaugh (1989) argue that most analyses of group discussions have been devoted to nonevaluative content coding of individual remarks. Some GDSS researchers (Dennis et al., 1988; Vogel & Nunamaker, 1990) point out the problems of existing GDSS evaluation studies: (1) many GDSS studies have virtually no theory associated with their variable choice and hypothesized relationships, (2) the absence of clearly specified models affects the quality of data analytic procedures, and (3) noncomparability of measures across studies is a major problem for progress in the research area. They conclude that the constructs must be more precisely defined and the measurement issues must be addressed in greater detail before empirical studies can be undertaken. So, what is required is a larger conceptual framework with criteria by which to judge the effectiveness of group decision-making in GDSS settings (McCartt & Rohrbaugh, 1989). The three theories employed in this study fulfills this requirement.

The purpose of this chapter is twofold: (1) I shall describe briefly 2 theories from which the questionnaires have been developed: Competing Values Approach (CVA) and Stratified Systems Theory (SST). And, (2) I shall reveal a close similarity between CVA and Jung's human information processing functions. Then, mainly encouraged by Rohrbaugh's (1989) trial, I shall show the close interrelationships between these 3 theories: Quinn and Rohrbaugh's Four Competing Decision-making Perspectives developed from their CVA to organisational effectiveness analysis (Quinn & Rohrbaugh, 1981;1983; Quinn, Rohrbaugh, & McGrath, 1985), Jung's Human Problem-Solving Style model (Jung, 1923;1971), and Jaques' Stratified Systems Theory of organisation (Jaques, 1976;1982). I shall also examine the articulation of the 3 theories empirically using the data collected from the questionnaires.

#### **4.1. Competing Values Approach (CVA)**

The development of the Competing Values Approach (CVA) framework provides a useful conceptual representation of the multiple perspectives on effective decision process. Therefore, if applied to GDSS area, this CVA framework can provide useful conceptual criteria to measure the effectiveness of a GDSS. So, the theoretical basic framework of the questionnaires to evaluate the effectiveness of decision conferencing is the CVA.

##### **4.1.1. CVA to organisational analysis**

In fact, the CVA was intended to provide a framework for understanding a wide variety of behaviours exhibited by organisations and the actors within organisations. The framework was developed by Quinn and Rohrbaugh (1983) through an empirical analysis of the criteria used by organisational researchers to evaluate organisational effectiveness. The CVA provides four divergent but complementary middle range models of organisational analysis (Quinn & Rohrbaugh, 1983):

- (i) an internal process model focuses on information management and coordination as the means by which stability and equilibrium can be developed as primary organisational objectives;
- (ii) a rational goal model focuses on planning and setting objectives as the means by which productivity and efficiency can be improved as primary organisational objectives;
- (iii) an open systems model focuses on flexibility and readiness as the means by which resource acquisition and growth can be increased as primary organisational objectives; and

(iv) a human relations model focuses on cohesion and morale as the means by which the development of human resources can be made greater as a primary organisational objective.

In combination, the internal process and rational goal model reflect consumatory concerns, that is, the integration of organisational parts; the open systems and human relations models reflect instrumental concerns, that is, the differentiation of organisational parts. These two pairs are reflective of Gouldner's (1959) two general models of organisational analysis: the rational model with an emphasis on formal, planned behaviour and the natural system model with an emphasis on flexible, spontaneous behaviour. The CVA framework also makes clear the parallel relation between these four models of organisational analysis and the four functional prerequisites of any system of action identified by Parsons (1959):

- (i) the integrative function,
- (ii) the goal attainment function,
- (iii) the adaptive function, and
- (iv) the pattern maintenance and tension management function.

Table IV-1 below presents the parallel relations between these three theories.

**Table IV-1: The comparison and match between 3 theories in organisational analysis**

Gouldner (1959)	Parsons (1959)	Quinn & Rohrbaugh (1983)
rational model	integrative function	internal process model
	goal attainment function	rational goal model
natural system model	adaptive function	open systems model
	pattern maintenance function	human relations model

#### 4.1.2. CVA to group decision processes

When the CVA framework is applied to the process of group decision-making as a particular system of action, four perspectives concerning the effectiveness of decision processes emerge (McCartt & Rohrbaugh, 1989; Milter & Rohrbaugh, 1985; Quinn, Rohrbaugh, & McGrath, 1985; Rohrbaugh, 1987). These perspectives can be considered to represent the four organisational analysis models discussed in the previous section. They are as follows:

- (i) an empirical perspective (parallel to the internal process model) emphasises the importance of evidence ("hard data") in a decision process. Particular attention is

directed to securing relevant information, developing reliable databases to provide decision support, and stressing the need for thorough documentation, computation, and full accountability. The preferred decision style tends toward slow, cautious stages of analysis that are explicit and retraceable. The two important criteria that emerge when an organisational decision process is evaluated from this perspective are information access and accountability.

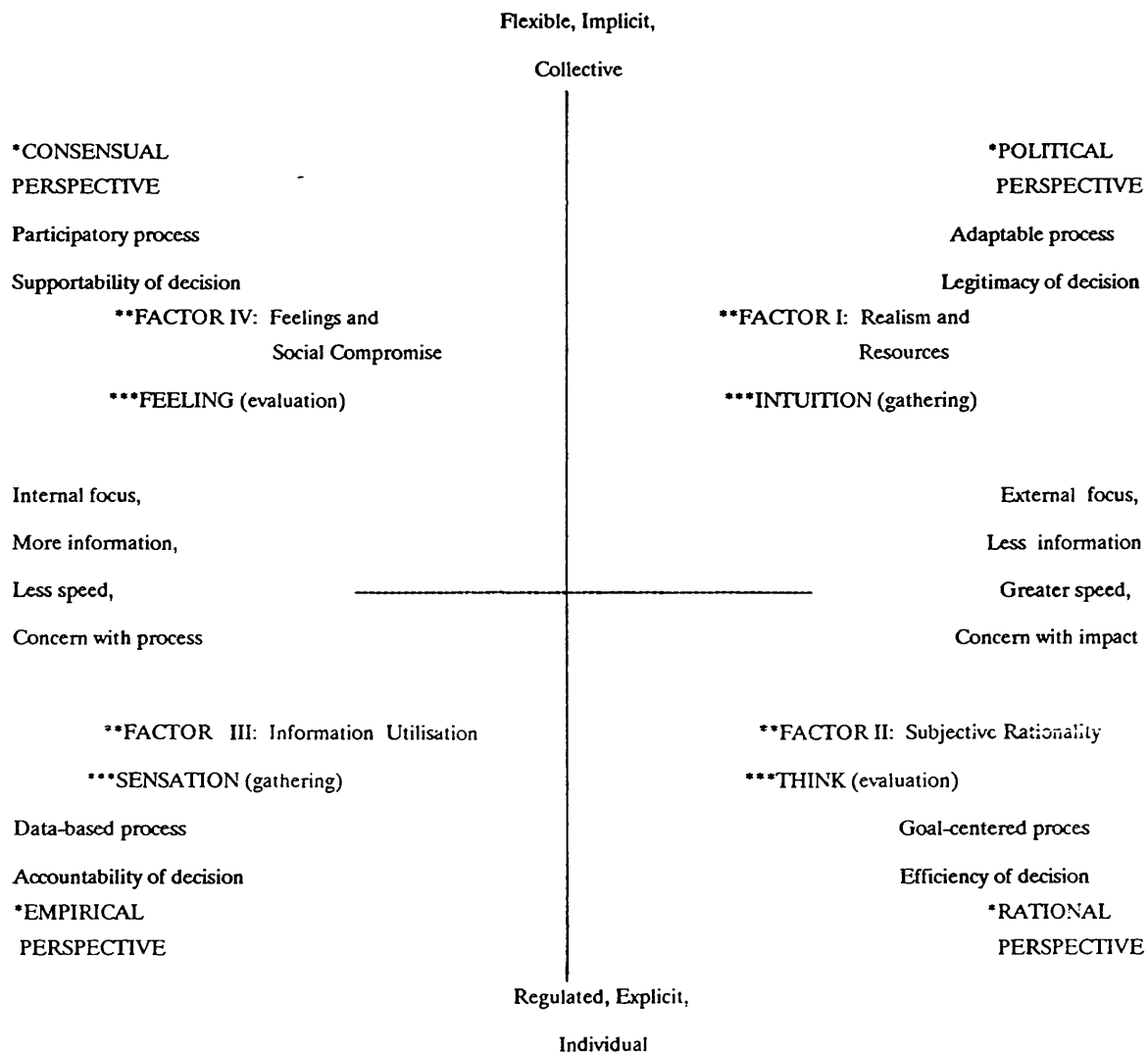
(ii) a rational perspective (parallel to the rational goal model) favours logic and clear thinking over empiricism, attends primarily to organisational goals and objectives, and tends toward methods that can efficiently assist decision makers with their reasoning, such as cognitive maps and preference technology. From this perspective, the best decision process is logical, timely, and justifiable. Two particularly important evaluation criteria emerge from this perspective: an effective decision process should be goal-centered and efficient.

(iii) a political perspective (parallel to the open systems model) values adaptability and flexibility in a creative decision process, is attuned to shifts in the problem environment, and is concerned about finding solutions that maintain or enhance the standing of the decision maker. A person with this perspective understands that decisions are often made in uncertain environments with constantly changing conditions, and recognises that final decisions must be seen as legitimacy by other affected parties. This orientation tends toward creativity, flexibility, and political urgency. Problems are not viewed as having final solutions; rather, limited decisions are made and then remade according to circumstances. This approach takes in the "big picture" and is particularly sensitive to the availability of resources, power, and the organisation's competitive position in the overall system. Emerging from this perspective of a decision process are two particularly important criteria: adaptability and external legitimacy.

(iv) a consensual perspective (parallel to the human relations model) expects a fully participatory decision process, advocates open expression of individual attitudes and beliefs, and prizes collective agreement on a mutually satisfactory solution. This perspective takes the view that decision making is tied to human interaction. As a result, the likelihood of support for the decision during implementation is increased. When an organisational decision process is assessed from this perspective, two particularly important criteria emerge: participation and support.

Figure IV-1 below graphically depicts the CVA framework with each viewpoint of effective decision-making represented as a quadrant. The empirical, rational, political, and consensual perspectives shown in figure IV-1 systemise 8 distinct performance criteria by which to judge effective group decision processes.

Figure IV-1: The Competing Values Approach (CVA) framework for group decision processes



\* : Rohrbaugh's CVA, \*\*: Zakay's Decision's Goodness Factor, \*\*\*: Jung's Information Processing Function

As shown in fig. IV-1, within each quadrant of the CV framework a particular decision process is judged by the nature of the process itself (i.e., data-based, goal-centered, adaptable, and participatory) and the type of decision associated with that type of process (i.e., accountability, efficiency, legitimacy, and supportability).

These 8 criteria offer explicit standards against which to judge the effectiveness of group decision processes. No single perspective is inherently right or wrong; all eight criteria reflect important considerations in evaluating decision processes. The CVA provides a useful conceptual representation of the multiple perspectives on effective decision processes.

These 4 perspectives of effective decision-making processes are well coordinated with other studies. Zakay (1984) uncovered these 4 perspectives of effective decision-making processes independently with a factor analysis of 25 items on his Decisions' Goodness Questionnaire: "Information Utilization" (e.g., all of the existing information is used; attempts are made to obtain missing information), "Subjective Rationality" (e.g., the decision is logical; internal consistency among all the values and probabilities used is kept), "Realism and Resources" (e.g., the decision was made at the right time; the decision could be carried out), and "Feelings and Social Compromise" (e.g., the decision maker has a good feeling about the decision; the decision is satisfactory to superiors). The 4 factors explained about two-thirds of the variance in the evaluation of decision processes by 145 industrial managers. Taggart and Robey (1981) similarly noted 4 dominant decision-making styles as "matter of fact", "logical", "insightful", and "sympathetic".

#### **4.2. Human Problem-solving Style Model**

Jung (1923; 1971) theorised four psychological functions that are involved in information gathering and evaluation: sensation (S), intuition (I), thinking (T), and feeling (F). According to Jung, individuals gather information either by sensation or intuition, but not by both simultaneously. Similarly, the thinking and feeling functions represent extreme orientations in evaluating information. Only one of the four functions is dominant in each individual. However, the dominant function is normally backed up by one (and only one) of the functions from the other set of paired opposites. No one can be classified totally as belonging to one category or the other, in terms of gathering or evaluating information.

Comparing Jung's human information processing function model to CVA, we can find that both models share considerable similarity to each other. The basic concepts of CVA's 4 perspectives of effective decision-making process look similar to those of Jung's 4 human information processing function. The components of each model correspond to each other respectively: Empirical vs. Sensation, Rational vs. Think, Political vs. Intuition, and Consensual vs. Feel.

#### **4.2.1. Information gathering function: Sensation versus Intuition**

##### **(1) Sensation type people: enjoy routine and structured job, like "hard" data**

Sensation type people tend to focus on details, specifics, hard realistic facts, and the "here and now." They believe in experience and rely on the past to learn how to approach current problems. They use words such as actual, down-to-earth, realistic, practical, utility, and past experience when making a presentation to others.

In terms of problem-solving style, these people tend to:

- dislike dealing with unstructured problems, because they contain considerable uncertainty and usually require the people to exercise some degree of judgement in deciding on a course of action and how to implement it,
- enjoy using skills already acquired more than learning new ones,
- work steadily, with a realistic idea of how long a task will take,
- be impatient when details get complicated, and
- distrust creative inspirations and usually do not get inspired.

##### **(2) Intuition type people: appear to be day-dreaming, but creative. like "soft" data**

Those who rely on intuition glean information from their imagination. They like to solve new problems, dislike doing the same things over and over again, jump to conclusions, become impatient with routine details, and dislike taking time for precision. Whereas the sensation type people tend to perceive the external environment in terms of details and parts, the intuition type people tend to perceive the whole, or totality, of the external environment- as it is and as it might change- and live in anticipation. The language of the intuitive type people is filled with metaphors and imagery. Words such as possible, fascinating, ingenious, and imaginative are used to describe people and things. Technical details often slip past them. They become impatient with people who do not see the immediate value of their ideas. Although they may appear to be day-dreaming, they are probably forming concepts and integrating experiences to determine the reasons behind things.

In terms of problem-solving style, the intuitive type people tend to:

- keep the total picture or overall problem continually in mind as the problem-solving process develops,
- show a tendency, willingness, and openness to continuously redefine the problem,
- rely on hunches and nonverbal cues,
- almost simultaneously consider a variety of alternatives and options,
- jump around or back and forth among the usual sequence of steps in the problem-solving process and may even suddenly want to reassess whether the "true" problem has been identified, and



- quickly consider and discard alternatives.

#### **4.2.2. Information evaluation function: Feeling versus Thinking**

##### (1) Feeling type people: personal and subjective judgement

This type people use their own unique, personal value judgement to evaluate information. Feeling types particularise. They are aware of other people and their feelings, like harmony, need occasional praise, dislike telling people unpleasant things, tend to be sympathetic, and relate well to most people. They would probably conform to a high degree and accommodate themselves to other people. They tend to make decisions that result in approval from others. They emphasise emotional and personal factors in decision making. When avoidance or smoothing over of differences is not possible, they often change their positions to those that are more acceptable to others. The establishment and maintenance of friendly relations may be more important to them than achievement, effectiveness, and decision making. They are emotional and spontaneous. They base their decisions on feelings.

In problem-solving style, feeling type people tend to:

- enjoy pleasing people, even in ways that others consider unimportant,
- dislike dealing with problems that require them to tell people unpleasant things,
- be responsive and sympathetic to other people's problems,
- heavily emphasise the human aspects in dealing with organisational problems, and
- see problems of inefficiency and ineffectiveness as caused by interpersonal and other human difficulties.

##### (2) Thinking type people: impersonal, objective judgement

People in this type tend to have a preference for impersonal principles and are not comfortable unless there is a logical or analytical basis for a decision. Thinking types generalise. They look for the common dimension in things and express it in abstract and theoretical terms. They are generally unemotional and uninterested in other people's feelings. The activities and decisions of these people are usually controlled by intellectual processes based on external data and generally accepted ideas and values; problems and their solutions are fitted into standardised formulas.

They are organised and structured, and they doggedly pursue facts. They seldom leap to conclusions but prefer to consider carefully all options before making a decision. They are conservative in risk taking. On the negative side, they can get bogged down in analysing situations over and over again. At worst, they can be perceived by others to be rigid, dogmatic, and boring.

In terms of a problem-solving style, they are likely to:

- make a plan and look for a method to solve the problem,
- be extremely conscious of and concerned with their approach to a problem,
- define carefully the specific constraints in the problem,
- proceed by increasingly refining their analysis, and
- search for and obtain additional information in a very orderly manner.

Each style views a problem differently and therefore will surface different assumptions and assign different importances and certainties to them. So, it tends to lead to decisions in a different way. Myers (1980) found that 75 % of the general population in the U.S.A. reports a preference for gathering information through sensation, while 25 % indicates a preference for intuition. And, 70 % use thinking when evaluating information, while only 30 % tend to emphasise feeling.

There is considerable similarity among the thinking type person's problem-solving style, the major elements in the scientific method, and what U.S. society characterises as rational problem solving. Educational institutions emphasise development of the thinking function. The sensation-thinking combination characterises best the people in today's Western industrialised societies. This characteristic is obviously important in an advanced industrialised society, but the assumed superiority of the thinking over the feeling function has been overemphasized (Hellriegel et al., 1986). Jung also believes that the developing individual tends to move toward a balance, or integration, of the four psychological functions.

#### **4.2.3. Composite problem-solving style**

Jung addresses a composite problem-solving style based on two functions results in the categories of (1) sensation-thinker (ST); (2) sensation-feeler (SF); (3) intuitive-thinker (IT); and intuitive-feeler (IF).

##### **(1) Sensation-Thinker (ST): rules, facts, stability, impersonality-oriented**

ST managers tend to be empiricists who sense and think their way through life, making judgements and interpretations on the basis of "hard facts" and logical analysis. They want their organisations to be run on facts and figures. They will establish effective managerial rules and regulations to create a stable organisation. They typically interact formally and impersonally with others in the organisation. An organisation that does not have some ST managers may not be run efficiently and effectively. Since they excel in preserving the procedures and rules of the organisation, they may also preserve less successful ones not to notice new situations that need attention. These responses may not be desirable when rapid change is necessary.

Their idea of organisational effectiveness tends to focus on such variables as sales per full-time sales person, rate of return on investment, short term profits, value of production per labour hour, and cost of goods sold.

**(2) Intuitive-Thinker (IT): impersonality, change, new idea-oriented**

IT managers tend to work their way through life by thinking about the possibilities inherent in a situation, but analyse them impersonally. Their actions tend to be shaped by ideas and insight rather than facts. They are the architects of progress and ideas. An organisation that does not have ITs in management will undergo minimal change, and sooner or later organisational profits will decline. They may encounter difficulty in their interpersonal relations. They enjoy solving new problems.

They probably determine organisational effectiveness by such variables as rate of new product development, market share, growth in earnings and long-run profits, new market development, and degree of action on and response to environmental changes.

**(3) Sensation-Feeler (SF): stable, realistic, personal contact-oriented**

SF managers tend to pay a great deal of attention to data derived from the senses, but arrive at judgements in terms of "what feels right" rather than in terms of analysis. They negotiate with ease and are natural troubleshooters or diplomats. They have the talent for getting people to cooperate with them and with each other on the basis of expediency. They do not fight the system: they use available means to solve problems rather than try to change the reality of the system. They do not like abstract, and unfamiliar ideas and tend to react negatively to extreme change.

Organisational effectiveness is determined by such factors as employee loyalty, attitudes, grievances, turnover, and absenteeism.

**(4) Intuitive-Feeler (IF): sociable, personal, public relation-oriented**

IF managers tend to be guided by a combination of insight and feeling which pays much more attention to values than to facts. Personal charisma and commitment to the people they lead highlight the problem-solving style of IFs. The organisation without IF managers may find the environment cold, sterile, joyless, and dull. They focus on developing individuals within the organisations. They are deeply committed to the career progress of subordinates and strive to enhance subordinate's personal growth. They may find themselves making administrative decisions on the basis of their personal likes and dislikes rather than on the basis of performance measures. They want to please all the people all the time. They may become so responsive to the demands of others that they lose sight of their own values, beliefs, and goals. They are sociable and enjoy being where people are gathered. They find their office a source of social satisfaction as well as a place to work. Organisational effectiveness is judged by

consumer satisfaction, social responsibility, ability to identify problems or new opportunities, quality of life, and community satisfaction with the organisation.

Similarly, Quinn et al. (1985) note that:

(1) people associated with the Empirical and Rational perspectives are more regulated, analytical, explicit, and individualised. This corresponds to a Sensation-Thinker (ST).

(2) people associated with the Political and Rational perspectives are more externally focused, use less information, operate at greater speed, and are more concerned with impact. This combination of political and rational perspectives corresponds to a Intuitive-Thinker (IT).

(3) people associated with the Consensual and Empirical perspectives are more internally focused, use more information, operate more slowly, and are more concerned with process. This combination of consensual and empirical perspectives corresponds to a Sensation-Feeler (SF).

(4) people associated with the Consensual and Political perspectives are more flexible, intuitive, implicit, and collectivized. Again, this combination corresponds to a Intuitive-Feeler (IF).

Quinn et al. (1985) explain that the criteria in any given quadrant tend to complement somewhat the criteria in neighboring quadrants, and they stand in sharp contrast to criteria in the opposite quadrant. For example, a decision maker who is predisposed toward the rational perspective may neglect participation and supportability (2 main criteria in consensual perspective) in the design or evaluation of a decision process. This is exactly same with Jung's theory (see fig. IV-2).

Figure IV-2: Match between CVA and Jung's information processing function model

<p><b>Consensual Perspective</b></p> <p>Participatory process Supportability of decision</p> <p><i>Feeling in evaluation</i></p>	<p><b>Political Perspective</b></p> <p>Adaptable process Legitimacy of decision</p> <p><i>Intuition in gathering</i></p>
<p><b>Empirical Perspective</b></p> <p>Data-based process Accountability of decision</p> <p><i>Sensation in gathering</i></p>	<p><b>Rational Perspective</b></p> <p>Goal-centred process Efficiency of decision</p> <p><i>Thinking in evaluation</i></p>

Quinn et al. (1985) add that a particular perspective is not taken merely because of a person's value systems; situations involving time pressure and level of uncertainty play a role, too. When time pressures are high, little emphasis will be placed on the consensual and empirical approaches. Instead, emphasis will shift to criteria on the right of fig. IV-2. When time horizons are long, the opposite shift may occur. When uncertainty is high, tightly regulated, analytical methods are less likely to be used as the emphasis shifts toward the top of fig. IV-2. When certainty increases, the emphasis will shift toward more empirical and rational approaches. Even though all eight criteria in fig. IV-2 are important aspects of effective decision making, unfortunately individual values, situational pressures, and disciplinary orientations work against the integration of perspectives. Jung also pointed this: the environment in which individuals function can be as important or more important than their problem-solving styles (Hellriegel et al., 1986. p.135).

Table IV-2 below shows the interrelationship between these 4 models, matching to each corresponding criterion.

**Table IV-2: Comparison and match of the 4 theories in decision-making paradigm**

Zakay (1984)	Quinn & Rohrbaugh (1983)	Taggart & Robey (1981)	Jung (1923)
Information Utilisation	Empirical	Matter of fact	Sensation (gathering information)
Subjective Rationality	Rational	Logical	Thinking (evaluating information)
Realism and Resource	Political	Insightful	Intuition (gathering information)
Feelings and Social compromise	Consensual	Sympathetic	Feeling (evaluating information)

\* Zakay's factor analysis of decision's goodness (1984)

Rohrbaugh's 4 perspectives in group decision process (1985)

Taggart and Robey's decision-making style (1981)

Jung's information processing function (1923)

### **4.3. Stratified Systems Theory (SST)**

Phillips (1984a) employed the work of Elliott Jaques on Stratified Systems Theory (SST) (Jaques, 1976;1982) to judge the effectiveness of decision support systems. He explains the major reason why computer-based management and DSS have been of relatively limited use to top management is because IS designers have not taken seriously into account that individuals progressing up the executive hierarchy will experience abrupt changes in the discretionary content of their jobs when they move between strata.

Recently, Rohrbaugh (1989) shows that SST provides a useful basis for more thoroughly exploring the presence of competing values in organizational analysis. He corresponds one or two of perspectives in CVA model to each 8 stratum in SST. As we saw before, there is a so close similar interconnections between 2 models: CVA and Jung's problem-solving style model. If Rohrbaugh's (1989) argument is true, then, we can draw the interrelationships between the stratum in SST and specific problem-solving style of an individual in that stratum. I, then, compare these interrelationships with Jaques' descriptions of the one particular category of task demand specific to each organisational stratum. If all of these articulations are consistent and relevant to each other, we could say what problem-solving style managers are more suitable to a specific stratum in an organisation than others.

In part II of the Decision Conferencing questionnaires, I asked the participants of Decision Conferencings to answer their perceived stratum in their own organisation, and their ideal relative importance between 4 decision-making perspectives in CVA. The questionnaire data are also analysed bearing in mind those interrelationships between the theories.

#### **4.3.1. SST with CVA and Human Problem-solving Style Model**

Jaques and his colleagues have proposed a common structure for all organisations, large or small, public or private, located in the East or the West, providing goods or services. This structure has eight strata or levels, with boundaries between strata representing qualitative shifts in the nature of work within each level. Associated with the boundary between each stratum is what Jaques calls the time span of discretion. This indicates the amount of time an individual would be expected to work unsupervised at the longest task in a job. It is the time it would take a manager to be sure that an employee was not satisfactorily balancing pace and quality in exercising

discretion. For job promotions within a stratum, the change in the position of decision makers merely means "more of the same," but promotions across boundaries result in quite different, more abstract, and far greater responsibilities ("more and different").

A full explanation of SST would need to describe the complete socio-technical system involving the individual's relationships to other people, to the social system as a whole and on the physical and technical resources available (Phillips, 1984a). For the purpose of this chapter, it is sufficient to indicate about the nature of work at each stratum to derive the main relationships with other models. For example, Rohrbaugh (1989) argues that the strata about which Jaques has written can be understood better when juxtaposed with the CVA. The dominant values that receive expression in each stratum are linked directly to the four alternative models of organizational analysis.

Work at Stratum I (Task complexity : Direct judgement) is carried out on the shop and office floor and is associated with distinct, concrete tasks that lead to output which can be concretely illustrated by a drawing or example of what is wanted. An individual at this level proceeds along a prescribed linear pathway to a goal, getting continual feedback in order to proceed, and using previously learned methods for overcoming immediate obstacles as they are encountered, or else reporting back (Jaques, 1989). Discretion is exercised in deciding how the rules are to be carried out (Phillips, 1984a). Rohrbaugh (1989) addresses that stratum I decision makers, while focused on the day-to-day demands of their work within the organization, must reconcile their own job satisfaction with the task specifications that explicitly direct their employment; their self-interest as employees spans the human relations and internal processes models. So, important criteria of decision-making perspectives in this stratum are consensual and empirical ones.

Roles at Stratum II (Task Complexity: Diagnostic Accumulation) are first-line managerial, professional and technical. This is the lowest level at which the "real" manager is found. People in these roles solve problems outside the ability of subordinates, put together a work programme of stratum I tasks and change the programme when necessary. Task outputs cannot be completely specified. They need some interpretation. An individual not only overcomes immediate obstacle as they are encountered but must be able to reflect on what is occurring so as to note things that might indicate potential problems and obstacles; and must accumulate and consciously sort such data to diagnose emerging problems, and initiate actions to prevent or overcome the problems identified (Jaques, 1989). This requires an ability to imagine how problems come out if performed differently, applying 'What if?'

mental analyses (Phillips, 1984a). Judgement is exercised in dealing effectively with subordinates, determining priorities and solving problems. Stratum II decision makers, called upon to perform the integrative function for an organisation, have the primary responsibility for basic coordination as first-line supervisors. For this reason, they are guided essentially by the values of the internal process model alone: maintaining control over the short-term, internal operation of the system [Rohrbaugh 1989]. So, important criterion for effective decision-making in this stratum is empirical perspective.

At Stratum III (Task Complexity: Alternative Paths) comprising roles associated with departmental management and principal specialist, people are concerned with whole systems of work, with organising tasks and controlling trends. Judgement is exercised in organising efficiently, in anticipating trends and making provisions for new systems of work that might be required to meet future changed circumstances (Phillips & Jaques, 1983). Managers in this level must not only use direct judgement plus diagnostic accumulation, but they must also be able to encompass the whole process within a plan that has a pathway to goal completion that you have worked out in the first place- and have pre-planned alternative paths to change to if need be (Jaques, 1989). They take on responsibility for anticipating and preparing for predictable events external to operations that may attenuate the unit's performance; their interests span the internal processes and rational goal models (Rohrbaugh, 1989). So empirical and rational perspectives in decision-making perspectives are regarded as most important at this level managers.

Stratum IV (Task Complexity: Parallel Processing) which comprises general management and chief specialist roles, people are concerned with systems of operations and with methods of obtaining output rather than with the performance of specific tasks in themselves. Judgement is exercised in abstracting general issues from specific cases, in anticipating changes required in general methods of doing the work and in identifying new opportunities for meeting corporate objectives, all with time horizons up to 5 years (Phillips & Jaques, 1983). Managers at this stratum have to parallel process several interacting projects, pacing them in relation to one another in resourcing and in time. They must make trade-offs between tasks in order to maintain progress along the composite route to the goal (Jaques, 1989). They are charged with the goal attainment function of the organisation. As general management, these individuals most embody the values of the rational goal model alone: planning and implementing work programs that are expected to most improve the midterm (3-5



year) profitability of their divisions (Rohrbaugh, 1989). So rational perspective in decision-making paradigms are regarded as most important at this level managers.

The Stratum V (Task Complexity: Unified Whole System) role is filled by the general manager of a corporate subsidiary, or by the managing director of a stratum V company, or by a top specialist. The type of work associated with these roles is that of defining whole fields of operations within policy that only partly defines the context of operations. Managers at this level have to cope by means of judgement with a constantly shifting kaleidoscope of events and consequences with far too many variables to map on a PERT chart. In pursuing the plan, you must sense interconnections between the variables in the organisation and the environment and continually adjust them in relation to each other with a sensing of all the internal and environmental 2nd- and 3rd-order effects (Jaques, 1989). Judgement is required in developing a successful enterprise, in setting goals; or in changing or redirecting previously set goals (Phillips, 1984a). The responsibility of stratum V decision makers is parallel to that in stratum I, although they must reconcile the competing values of flexibility and control at a more abstract level. Their interests span the rational goal and open system model (Rohrbaugh, 1989). The important criteria for this level managers in their decision-making perspectives are rational and political ones.

The Stratum VI (Task Complexity: World-wide Diagnostic Accumulation) role is associated with a corporate group of subsidiaries. The director of such a group must deal with social and theoretical systems as entities, and judgement is exercised in coordinating these systems, in developing groups of strategically related businesses, in providing business direction and in contributing to strategic thinking at corporate level (Phillips & Jaques, 1983). The managers in this level must develop networks so as to accumulate diagnostic information and to create a friendly environment throughout the world, making it possible to judge corporate investment priorities, to enhance the value of corporate assets as reflected in the balance sheet, and to contribute to corporate long-term success and survival (Jaques, 1989). Somewhat parallel to the reflective articulation of stratum II, the decision makers must develop 10 to 20- year strategies that assure the competitive advantage of their corporate group and that stress the importance of open systems' resource acquisition and growth. Their interests span the open system model alone (Rohrbaugh, 1989). Political perspective is thought be most important one from 4 perspectives.

At Stratum VII (Task Complexity: Put Business Units into Society) we can find the executive of director of a corporation. The work characteristic of this role is the

planning and organising of work in relation to societal development. Judgement is exercised in anticipating changes in the direction of societal movements, in assessing possible consequences of political, social, economic and technological developments, and in generating strategies that will enable the corporation to respond effectively to these changes (Phillips & Jaques, 1983). People in this stratum must develop and pursue alternative world-wide strategic plans, producing stratum V units by development, acquisitions, mergers or joint ventures, drawing upon internationally supported financial resourcing (Jaques, 1989). Extrapolations are made that parallel the work of stratum III, but here the forecasting is not analytical so much as synthetic and intuitive. Their interests span the human relations and open systems model (Rohrbaugh, 1989). Therefore, the political and consensual perspectives are important to this level managers.

Stratum VIII decision makers have ultimate responsibility for enhancing pattern maintenance and tension management functions of the larger society in which many systems operate. In searching for alternative systems, their work parallels the responsibilities in stratum IV, but, in contrast, they are guided by the value of the human relations model (cohesion and human resource development) where issues commonly come to the fore concerning an enhanced quality of life within future societies (i.e., pattern maintenance and tension management) (Rohrbaugh, 1989). The consensual perspective is the major concern to this level managers.

Work from I to III strata is concerned with direct output tasks, and is carried out in a department whose members can recognise each other. Above this level, work is less focussed on individual tasks and is more directed toward operations, with concern for the tactics that are employed in whole systems of operations. In short, managers act as general managers. Note that work at strata VI, VII and VIII is of a strategic nature, where the focus of concern is on social systems (Phillips & Jaques, 1983; Jaques, 1989). Work at stratum VI parallels that at stratum I, but whereas the entity at stratum I is the task, the entity at stratum VI is a social or theoretical system. In similar manner, Stratum VII echoes Stratum II, and so forth. This parallel suggests the possible existence of Strata VIII, IX, and X, but beyond Stratum VIII, the super corporations, there are as yet no organisations in existence (Phillips & Jaques, 1983).

Table IV-3. below shows the basic structure of work in organisations and associated CVA and Jung's information processing function model.

**Table IV-3: Basic structure of work in organisations and the associated perspectives in CVA and Jung's model**

Time span	Stratum	Organisational level	Main activity	Levels of task complexity	CVA	Jung
50 years	VIII	Super corporation chairman/CEO	Shaping society		Consensual	Feel (evaluation)
	VII	Corporation CEOs	Providing overall strategic direction	Construct complex systems	Political, Consensual	Intuition-Feeler
20 years	VI	Strategic groups of business units EVP	Creating strategy and translating it into business direction	Oversee complex systems	Political	Intuition (gathering)
10 years	V	Business unit president, Top specialists (VP)	Redefining goals and determining field of operation	Judge downstream consequences	Political, Rational	Intuition-Thinker
5 years	IV	Factory or sales org. G..M. ,Chief specialists	Creating methods of operation	Parallel process multiple paths	Rational	Think (evaluation)
2 years	III	Dept. or unit managers, Unit specialists	Organising programs into systems of work	Create alternative pathways	Empirical, Rational	Sensation-Thinker
1 year	II	1st line managers, Specialists	Generating programs of work	Data accumulation and diagnosis	Empirical	Sensation (gathering)
3 months	I	Operators, clerks	Doing concrete task	Direct, practical judgement	Empirical, Consensual	Sensation-Feeler
1 day						

Individuals progressing up the executive hierarchy will experience abrupt changes in the discretion of their jobs when they move between strata. For example, Jaques (1989) reveals one particular category of task demands specific to each organisational stratum. According to him, the task requirements for one stratum is qualitatively different from those for the other stratum.

It is interesting to note that there is a change in effectiveness criteria of decision-making from more regulated, analytical, explicit, and individualised-oriented to more flexible, intuitive, implicit, and collectivised-oriented as one progresses up the hierarchy. This is consistent with Jaques' satratum specific task complexity: from proceeding along a prescribed linear pathway to a goal to developing and pursuing alternative world-wide strategic plans bearing in mind to sense interconnections between constantly shifting kaleidoscope of events and consequences in the organisation and the environment (see Table IV-4).

**Table IV-4: Match between SST, CVA, Jung's Information Processing Model, and Jaques' Stratum Specific Task Complexity**

Stratum	4 decision-making perspectives (Rohrbaugh)	Human problem-solving style (Jung)	Levels of task complexity (Jaques)
VIII	Consensual	Feel (evaluation)	
VII	Political, Consensual	Intuition-Feeler	strategic options: alternative routes to make or transform operating systems
VI	Political	Intuition (gathering)	whole wide world data accumulation and diagnosis
V	Rational, Political	Intuitive-Thinker	practical judgement of immediate and downstream consequences of changes
IV	Rational	Think (evaluation)	parallel processing and trading off
III	Empirical, Rational	Sensation-Thinker	construct alternative routes to goals
II	Empirical	Sensation (gathering)	data accumulation and diagnosis
I	Consensual, Empirical	Sensation-Feeler	direct judgement

As we can see from table IV-4., to meet the needs of task complexity of *lower stratum (II-III: operation management domain)*, empirical and rational criteria in decision-making perspectives are more suitable. So, Sensation and Think type of person may be more appropriate to the job of these levels.

The task complexity in *middle level (IV-V: general management domain)* requires people to parallel process several interacting projects, to make trade-offs between tasks, and to sense interconnections between the variables in the organisation and the environment. Political and rational perspectives among CVA are more appropriate to meet these levels of task complexity. So, Intuition and Think type person may cope with well this type of task complexity.

And, the task complexity in *higher level (VI-VIII: corporate strategic domain)* requires people to coordinate the systems, to provide business direction, to contribute to strategic thinking at corporate level, to plan and organise the work in relation to societal development, and to develop alternative world-wide strategic plans. Political and consensual perspectives may be more required to meet these kind of task complexity. So, Intuition and Feel type managers may cope with well this requirement.

## CHAPTER 5. VARIABLES FOR THE TEST

### 5.1. Three Data Bases

A total of 22 Decision Conferencings (DCs) were selected for the study: 5 hosted by International Computer Limited (ICL), 12 by Decision Analysis Unit (DAU) at LSE in the U.K., and 5 by Decision Conferences, Inc. (DCI), in Colorado, U.S.A. The clients included 2 major computer manufacturing companies (11 DCs), one university (1 DC), one non-profit social service agency (1 DC), 4 other professional companies (4 DCs) from the U.K., and 1 electronic company (3 DCs), 2 TV companies (2 DCs) from the U.S.A. As we can see from these selections, the samples were chosen to represent the various types of client organisations.

Conferences ranged in size from 4 to 30 and averaged 12 participants. It is interesting to note that there are differences in group size between facilitators: average group size of the DC conducted by Phillips at DAU is 9.4, that of Hall at ICL is 13, and that of Peterson at DCI is 17.8. The managers ranged in managerial experience from 7 to 46 years with average 24 years, in current organisation tenure from 6 months to 38 years with average 13 years, and in current job tenure from 3 months to 14 years with average 3 years.

In the fall of 1989 and early 1990, questionnaires were sent to all participants for whom addresses remained available. Of the 245 questionnaires which were distributed, 142 were replied, resulting in a response rate of 58% (see table V-1). Full summary of sample DCs for questionnaire is provided at appendix 1.

**Table V-1: Response rate of questionnaires according to DC providers**

DC providers	# of Questionnaires		Response rate (%)
	Sent	Received	
DCI	89	57	64
DAU	101	61	60
ICL	55	24	44
Total	245	142	58

However, we must note that in the case of ICL and DAU, the sample DCs were chosen randomly by the investigator who had not conducted or attended the

corresponding DCs. In the case of DCI, however, the more successfully executed conferences were carefully chosen as samples by the facilitator based on his experiences and observations. So, the results of DCI may reflect the more successfully performed DCs, whereas those of DAU and ICL may reflect the mean of generally performed DCs. The other possibly important variable for interpreting the results is the nationality of respondents. Most respondents hosted by DCI are U.S.A. managers, whereas those hosted by ICL and DAU are U.K. managers. Thus, the results might reflect national differences.

## **5.2. Structure of the Questionnaire**

The questionnaire was designed to collect information from conference participants regarding their perceptions of the conference effectiveness compared to their conventional meeting. The questionnaire, provided in Appendix 2, consisted of four parts:

### **(1) Demographic items**

The first set of questions gathered information about the participants' job included their job title and responsibilities at the time of the conference, the length of their tenure in the position and the organisation, and the length of work experience in their whole career. It also contained the information about the participants' main functional area of business. The gender of the participants could generally be determined from their names.

### **(2) Individual's self-perceived stratum in his/her organisation in the context of Jaques' Stratified Systems Theory**

**(3) Perceived performance effectiveness of a DC in decision-making process compared to a conventional meeting, and**

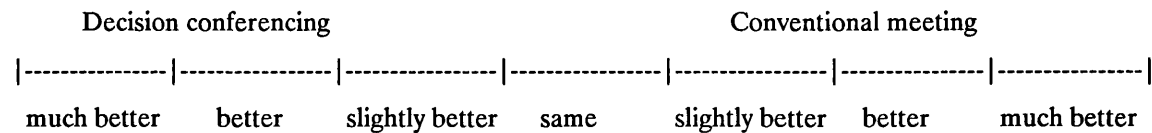
**(4) Individual's relative importance (preference) of four competing approaches to decision-making.**

## **5.3. Scales and Unit of Measures**

The major concern of this study is with the effects of a DC on the level of the participant's perceived effectiveness in their decision-making activity. Items 1 through 12 in Part I of the questionnaire were presented as statements in which the respondents were asked to indicate the post-session judgement about comparing their DC with a similar conventional meeting by marking an "X" on a 7 point Likert type scale. This rating method is quite relevant, since most respondents of the questionnaire have so experienced conventional meetings for equivalent tasks. Scale

scores could range from 1 (i.e, if respondents think conventional meetings are "much better" than DCs with regard to the component items of the questionnaire) to 7 (i.e., if respondents think DCs are "much better" than conventional meetings with regard to the component items of the questionnaire); higher scores reflect more positive attitudes toward a DC as a group intervention method, whereas score 4 shows no difference in attitudes about a DC compared to the conventional meeting.

Eg., All participants had ample opportunity to contribute freely to the decision.



Although the main purpose for a conference is to support a group in collectively making a mutually satisfactory decision, the participants in a DC obviously are affected by the conference at the individual level. Moreover, some particular independent variables such as participants' difference in terms of the strata, the number of DC attendance, and working careers require the use of individual scores as a unit of analysis. Therefore, using the individual participants rather than the conference as the unit of analysis, tests of differences between facilitators, group size, tasks, and participants' organisations, strata, the number of DC attendance, and main working careers were conducted to explore possible explanations for observed variability in the perceived level of conference effectiveness. But, when necessary, individual point values were summed and then divided by the number of group members in each DC to get the aggregated group perception score for that conference. Then, this aggregated conference values were used as the unit of analysis. Anyhow, the results of both approaches did not differ much from each other.

#### 5.4. Independent Variables

Every DC is unique with regard to the variety of facilitators, participants themselves, participants' organisational cultures, assigned task, and etc. So, the independent variables for the investigation are as follows:

1. System differences in terms of the variety of facilitators
2. Subjects' differences
  - (1) Participants' different strata
  - (2) Different group size
  - (3) Different organisations
  - (4) Prior experiences with DCs
  - (5) Main careers of the subjects
3. Task differences

### 5.4.1. Variety of facilitators

Unlike other computer-oriented GDSSs, one of the most important components of DCs is the facilitator. Here, facilitators not only select what software to be used but also direct the process of the meeting. More importantly, they help participants to construct a framework which includes all the different aspects of the problem.

So, we can expect that the results of DCs might be partly influenced by facilitators. Because they are human beings, facilitators can have naturally their own "philosophy" about how to facilitate a DC (in other words, what a good decision-making process should be).

Interestingly, personal conversations with some prominent facilitators of a DC led me to realise the differences between their beliefs. Table V-2 below shows one aspect of how facilitators are different from each other with respect to their beliefs in the decision-making process.

**Table V-2: Comparison between facilitators in their beliefs about the relative importance of the decision-making phases**

Facilitator	Stages in decision-making process			
	Problem recognition	Generation of options and criteria	Evaluation	Implementation
Hall	20	20	20	40
Peterson	30	15	5	50
Phillips	25	15	35	25
Rohrbaugh	35	20	30	15
Wooler	20	15	45	20

It tells us that facilitators have different beliefs about the relative importance of various stages in decision-making process. For example, while one facilitator (Peterson of DCI) regards the implementation stage to be more important than the others, another facilitator (Phillips of L.S.E.) considers the evaluation stage to be the most important one. Furthermore, some facilitators prefer to impose more rigid structure to the process (a fixed sequence of activities), or to direct the process in maximum their control; whereas, others prefer to let group members decide what they want to do, and to guide the process in minimum their control. Therefore, it must be interesting to investigate the impact of the variety of facilitators on participants' perception of the effectiveness of DCs.



## 5.4.2. Subject differences

### (1) Participants' different strata

As we saw before, Jaques and his colleagues (1976, 1982) have proposed a common structure for all organisations, which has eight strata, with boundaries between strata representing qualitative shifts in the nature of work within each level. They state that individuals progressing up the hierarchy will experience abrupt changes in the discretion of their jobs when they move between strata. Task requirements for one stratum to another differ in the extent to which personal judgements can be made or predefined procedures have to be followed. Typically, the proportion of discretionary to rule-based content becomes greater as one climbs the executive hierarchy (Phillips, 1984a). In other words, the characteristics of task becomes more abstract (from real to conceptual projects) as one progresses up the hierarchy. Therefore, unlike lower management levels (operation management domain: stratum II-III), the type of task of the senior management levels (general management domain: stratum IV-V, and corporate strategic domain: stratum VI-VIII) requires managers to exercise more discretion. This includes assessing uncertainty about the future, judging the value of possible consequences of decisions, formulating time and risk preferences, and making trade offs among objectives. These needs require senior managers to rely much more heavily on judgement and intuition. In addition, they need to deal with a variety of problems of different structural types.

Because of the increased degree of abstractions in their tasks, higher strata managers may increasingly want to see their more "invisible" (abstract and conceptual) problems "with their own eyes." Therefore, Phillips (1984a) argues that the type of decision support system appropriate to different levels within an organisation depends on the balance between discretion and rule-based work in particular job roles. In other words, the shift in the way discretion is exercised from one level to the next alters the nature of decision support required. He (1984a) points that these shifts have not been taken sufficiently into account in decision support systems; the vast majority of computer systems are aimed at satisfying the more rule-based tasks common at the lower strata. To help these senior managers, he argues that a decision support system for top managers must be particularly good at aiding discretionary activity. To achieve this purpose, he (1984a; 1988) adds that a system must have three main parts: decision makers and major problem owners, computer systems, and specialist facilitators. Computer modelling is used to put together all the pieces of the problem in one framework and to show the problem owners the implications of their judgements. The

facilitator provides the flexibility that is needed to represent the different aspects of the problem with different structures. The problem owners contribute the vital ingredient: content.

It seems to me that the end product of the integration of these three elements is the requisite model (Phillips, 1982; 1984b) of the task at problem owners' hands. This requisite model may be the *satisficingly* (finding the best stage as opposed to a merely satisfactory stage (Janis & Mann, 1977; Simon, 1976)) visualised version of their abstract, and conceptual tasks. Phillips (1984a) asserts that it is the integration of these three elements which is needed for true decision support for top executives. He, then, claims that a DC which consists of these three elements, is one type of decision support for top managers.

Most GDSS researches so far have been concentrated on the variables such as group size, task difficulty, or technical configurations to investigate the system effectiveness. However, Different stratum means different task (from rule-based work to discretionary one, or from concrete real task to abstract conceptual one), different environments, and different quality and quantity of information needed. There is little reason to believe that the effectiveness of a GDSS should be consistent to all levels of managers. Many top managers do, of course, make valuable use of computer aids even though systems are not available to handle all their discretionary needs. Because work at all levels is made up of many tasks, some with more concrete pictures than others. A system that provides adequate support for stratum II, for example, will be found wanting at, say, stratum IV. In fact, simple information retrieval system can be of great benefit to the highest levels of management by giving them an accurate and timely picture of what is occurring in the organisation. But, these lower level systems become useless when top managers have to deal with the conceptual works which require them to exercise discretion. Of course, most of the important works they are faced with are conceptual ones. Therefore, it is necessary for GDSS researchers to investigate the effects of stratum differences on their GDSS effectiveness. Their generalisations about the GDSS effectiveness could be affected by the participants' stratum differences as well.

In short, theory (Jaques, 1989) argues that the characteristics of the task demands become more abstract and conceptual as one progresses up the executive hierarchy. It seems to me very natural to expect that, unlike lower stratum managers, higher level executives may desire to visualise their more "invisible" (abstract and conceptual) problems. The integration of the three elements of a DC mentioned above is thought

to help senior executives to realise their desire. Therefore, we can expect that the perceived effectiveness of a DC would be higher as one climbs the organisational hierarchy.

Here, the degree of differences in the perceived effectiveness of a DC between different strata managers are examined. This study may be the first attempt in GDSS field to examine empirically the effects of participants' strata differences on the perceived effectiveness of a GDSS.

### **(2) Different group size**

As we reviewed in previous chapter, many researchers regard the group size as an important variable to determine the effectiveness of a GDSS.

It is interesting to note from the sample DCs that there were differences in the average of group size between facilitators: average group size of DCs conducted by Phillips was 9.4, that of Hall was 13, and Peterson was 17.8. It might represent Peterson prefers conducting larger groups compared to other facilitators. A big difference in group size may require different type of group facilitation method. Therefore, this difference may also mean facilitators differ from each other in their preferred facilitation method. For example, voting or more structured process method may be preferred to facilitate larger groups.

If these conjectures are correct, then, for example, the results of the DC facilitated by Peterson might be more positive with larger group size than those with smaller group size. Therefore, the effect of group size on the perceived effectiveness of DCs are tested within the boundary of the sample DCs conducted by each facilitator.

### **(3) Different organisations**

An organisational characteristics can also influence the users' perceptions to the new technology. For example, the perceived effectiveness of DCs of the public sector people may be different from those of computer manufacturing company. In this study, the results of ICL managers were compared with those of other companies' managers, all were British managers, and facilitated by Phillips. The results of Westinghouse managers were also compared with those of TV industry managers, all were American managers, and facilitated by Peterson.

#### **(4) The number of DCs a participant had attended**

As we saw in previous chapter, prior experience with a GDSS is so determinant variable for the success of the GDSS meeting, especially in case of a user-access type GDSS. A DC is an analyst (or recordist)-access type GDSS. Can the generalisation drawn from user-access GDSS environments be applied to analyst (or recordist)-access GDSS settings? Here, the relationships between the number of DCs a participant had attended and the perceived effectiveness of DCs were explored.

#### **(5) Main working careers of the subjects**

The perceived effectiveness of DCs was tested as to whether it was affected by the respondents' main careers in their working lives.

#### **5.4.3. Task differences**

Undoubtedly the task is an important variable for determining group effectiveness. In some research, group task has accounted for as much as 50% of the variance in group performance (Poole et al., 1985). Task determines the need for information and the consequent communication practices of the decision-making group.

Many GDSS researchers (Gallupe, 1986; Gallupe et al., 1988; Jarvenpaa et al., 1988; Zigurs et al., 1988; Bui & Sivasankaran, 1990) have shown that use of a GDSS has more positive effects on the meeting outcomes when dealing with more complex tasks compared to less complex ones. I wonder, however, whether these findings from experimental laboratory settings with controlling the level of task difficulty can be useful to the application of a GDSS to the real world. The reasons for my skepticism are twofold. First, while hypothetical task in experimental studies are usually isolated from other world tasks, real tasks are socially, culturally, interpersonally, and sequentially interrelated with other problems. Also, experimental tasks must be suitable for the experimental subjects (usually students) and the time for which they have agreed to participate (mostly one session with at most few hours, but typically less than an hour). However, important tasks addressed by business professionals have been commonly explored in several layers requiring several sessions. Therefore, the degree of the complexity of experimental task is far below that of important tasks faced by real business managers. Second, different from simple information retrieval systems, the main purpose of employing a GDSS in the real world is to get better decisions when dealing with very important and complex tasks. Why do executives

bother to employ a GDSS to tackle easy and trivial tasks? For example, the tasks brought in DCs are all difficult and important for the most of participants in the conference. Although they are already experts in their own field, they call for the services of a DC because they want to handle their important and difficult tasks more effectively. They would never pay for having a DC to tackle easy or trivial tasks. Therefore, most tasks receiving aid of a GDSS in real world setting cannot be easily distinguished by the task difficulty.

Chun (1988b) elsewhere examined a selection of 12 cases of DCs in similar conditions (participants of 12 sample decision conferences were from one organisation, used same software, and were guided by same facilitator) but which differed in the degree of threat expressed by the group in their discussion at the initial problem-formulation stage. High threat groups indicated that they were in some difficulty, experiencing loss of profits, declining market share, lack of competitiveness, etc. Low threat groups usually talked about having more opportunities than they could realise with their limited resources, were usually operating profitably and often growing. The degree of threat has been found to have a pronounced influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options compared to low threat groups.

So, it may be worthwhile to investigate the relationships between the degree of task threat and participants' perceived effectiveness of DCs, especially with regard to decision quality which is measured by the number of options and criteria in evaluating those options.

## **5.5. Dependent Variables**

### **5.5.1. Decision process measures**

The 8 items (questions from 1 to 8) on the part I of the questionnaire pertained to the perceived effectiveness of the decision process at the conference compared to a conventional meeting. These items provided the basis for constructing 8 scales, one for each criterion associated with the CVA framework.

Figure V-1 visually depicts this association. As shown in fig. V-1, within each quadrant of the CV framework a particular decision process is judged by the nature of the process itself (i.e., Q1: participatory process, Q2: data-based process, Q6: goal-centered process, and Q3: adaptable process) and the type of decision associated with

that type of process (i.e., Q8: supportability of decision, Q7: accountability of decision, Q5: efficiency of decision, and Q4: legitimacy of decision). Similarly, Gallupe and McKeen (1990) define the perceived reactions to the decision process (group member perception) as the group members' feelings about the decision process and the decision they have made: satisfaction with the process and decision confidence.

**Figure V-1: Eight criteria based on CVA to measure group decision-making effectiveness**

<p>CONSENSUAL PERSPECTIVE</p> <p><b>Participatory process (Q1)</b></p> <p><b>Supportability of decision(Q8)</b></p>	<p>POLITICAL PERSPECTIVE</p> <p><b>Adaptable process(Q3)</b></p> <p><b>Legitimacy of decision(Q4)</b></p>
<p>EMPIRICAL PERSPECTIVE</p> <p><b>Data-based process(Q2)</b></p> <p><b>Accountability of decision(Q7)</b></p>	<p>RATIONAL PERSPECTIVE</p> <p><b>Goal-centered process(Q6)</b></p> <p><b>Efficiency of decision(Q5)</b></p>

The 8 criteria offer explicit standards against which to judge the effectiveness of group decision processes:

Q1. All participants had ample opportunity to contribute freely to the decision. (Participatory process)

Q2. All relevant information was considered. (Data-based process)

Q3. The decision-making process was adaptable and flexible, and stimulated creative problem solving. (Adaptable process)

Q4. The resulting decisions from the meeting were accepted by other affected parties. (Legitimacy of decision = decision acceptance)

Q5. The meeting was worth the investment of time and effort. (Efficiency of decision)

Q6. The decision-making process was clear and rational, and the resulting decisions were logical and justifiable in the light of available information. (Goal-centered process)

Q7. We left the meeting knowing who was accountable for every agreed action. (Accountability of decision)

Q8. Actions agreed during the meeting were implemented. (Supportability of decision = implementation of decision)

### **5.5.2. Attitudes toward a DC overall**

Q9. While attending the meeting, I felt challenged to do my best work, and really felt like I accomplished something. (Challenge and accomplishment)

Q10. Attending the meeting was a useful learning experience. (Enhancement of problem-solving ability)

### 5.5.3. Decision quality

Q11. The number of alternatives generated.

Q12. The number of criteria considered.

### 5.5.4. Participant's ideal relative values regarding 4 competing decision making perspectives

Subjects were asked to allocate 100 points among the four competing decision-making perspectives (rational, empirical, consensual, and political) based on CVA to represent the relative importance of the perspectives to them.

Rational perspective: ensuring the decision is the result of a logical, rational process.

Consensual perspective: ensuring the decision is based on the participation of all interested parties.

Empirical perspective: ensuring the decision is based on a thorough analysis of all relevant data.

Political perspective: ensuring the decision is the result of a flexible, creative process.

So, the result may represent the ideal decision-making perspectives of the subjects.

## 5.6. Analysis Method

Most analyses involved looking at the effect of an independent variable on an dependent one. Sometimes this was accomplished simply by comparing graphical plots; sometimes statistical procedures, for both qualitative and quantitative variables, were used. Although, simple, bi-variate statistical analyses are the most that were required to test the hypotheses, T test and ANOVA procedures in MINITAB (version 7.1., Mendenhall, 1987; Ryan et al., 1985) were also employed. The results of two statistical analysis procedures were represented as a p-value. A p-value is a measure of the credibility of null hypothesis  $H_0$ . It tells us how much (or how little)  $H_0$  is supported by the data. So low p-value leads us to conclude that  $H_0$  is an implausible hypothesis. Applied statistics increasingly prefer p-value to classical hypothesis testing, because classical tests involve setting the error level of the test arbitrarily (usually at 5%). Rather than introduce such an arbitrary element, it is often preferable just to

quote the p-value, leaving the leader to pass his own judgement on *H<sub>0</sub>* (Wonnacott & Wonnacott, 1984).

The other statistical technique employed in this study is a Spearman's rank correlation coefficient ( $r_s$ ) in MINITAB.

Overall, balanced emphasis were placed on between statistical significance and the magnitude of effects that could have practical import. Because, all of three data bases could hardly be considered a random sample of any population of general interest.

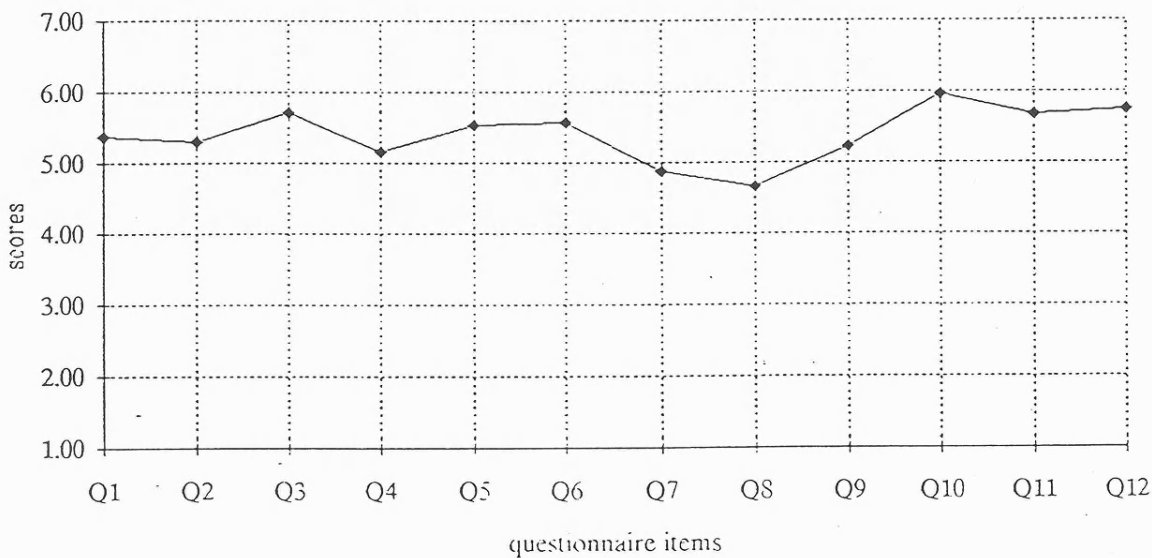


## CHAPTER 6. FINDINGS

### 6.1. Overall Findings

It was found that DCs were evaluated better than conventional meetings with respect to all of the 12 evaluation criteria (see fig. VI-1).

**Figure VI-1: Overall DC effectiveness (total ave. of individual scores. Peterson, Phillips, Hall & Wooler altogether. various organisations. American & British managers. n = 142)**



Questions	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12
Mean values	5.37	5.30	5.70	5.16	5.53	5.57	4.88	4.66	5.23	5.96	5.67	5.74

\* 4.00: same to a conventional meeting

The 12 evaluation criteria could be categorised into 3 groups based on the mean values on each criterion. DCs were perceived as:

(1) *highly effective* (mean value = 5.5-6.0) with regard to the criteria of Attitudes in terms of enhancement of problem-solving ability (Q10), Decision quality (both the number of criteria and alternatives generated. Q12, Q11), Adaptable process (Q3), Goal-centred process (Q6), and Efficiency of decision (Q5),

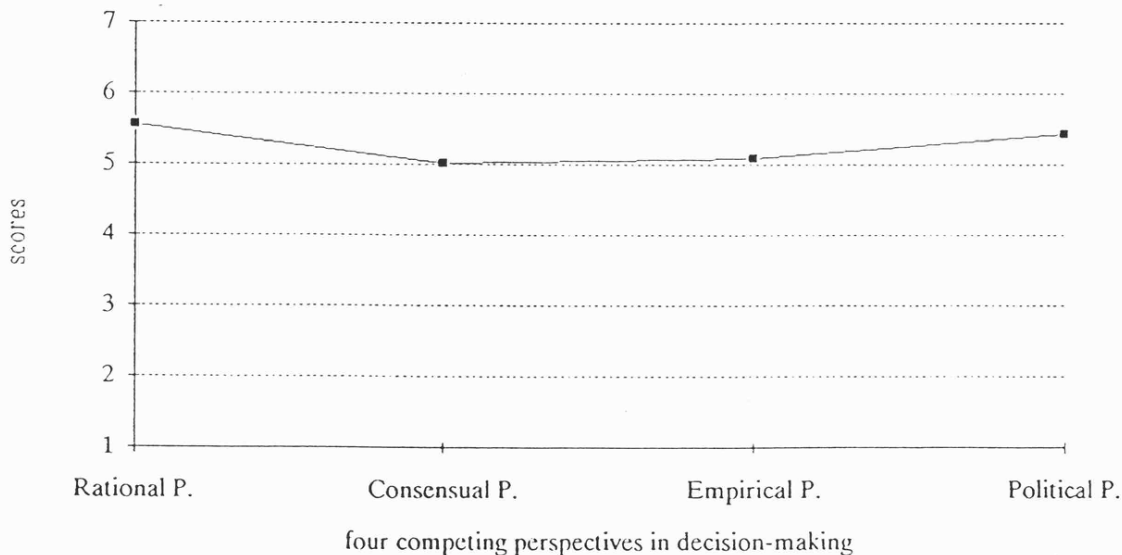
(2) *moderately effective* (mean value = 5.0-5.49) with regard to Participatory process (Q1), Data-based process (Q2), Attitudes in terms of challenge and accomplishment (Q9), and Legitimacy of decision (= decision acceptance. Q4), and

(3) *less effective* (mean value=4.5-4.99) with respect to Accountability of decision (Q7), and Supportability of decision(=implementation of decision Q8).

Figure VI-2 below shows the perceived effectiveness of DCs measured based on four competing decision-making perspectives. As we saw in previous section (see fig IV-2), each perspective is comprised of two performance criteria by which to judge effective group decision processes: one is process itself, and the other is respective outcome. For example, rational perspective consists of goal-centred process and efficiency of decision. So, the perceived DC effectiveness with regard to rational perspective is calculated by averaging the mean value of Q6 and Q5.

It tells us that participants perceived the aid of DCs to be more effective with regard to rational and political aspects of decision-making process compared to consensual and empirical ones. In other words, participants rated the intervention of DCs more effective in terms of the logical, rational, flexible, and creative process compared to the aspects of the participation of all interested parties or thorough analysis of all relevant data.

**Figure VI-2: Overall DC effectiveness based on 4 competing values (total ave. of individual score. Peterson, Phillips, Hall & Wooler altogether. various organisations. American & British managers. n =142)**



(3) *less effective* (mean value=4.5-4.99) with respect to Accountability of decision (Q7), and Supportability of decision(=implementation of decision Q8).

Figure VI-2 below shows the perceived effectiveness of DCs measured based on four competing decision-making perspectives. As we saw in previous section (see fig IV-2), each perspective is comprised of two performance criteria by which to judge effective group decision processes: one is process itself, and the other is respective outcome. For example, rational perspective consists of goal-centred process and efficiency of decision. So, the perceived DC effectiveness with regard to rational perspective is calculated by averaging the mean value of Q6 and Q5.

It tells us that participants perceived the aid of DCs to be more effective with regard to rational and political aspects of decision-making process compared to consensual and empirical ones. In other words, participants rated the intervention of DCs more effective in terms of the logical, rational, flexible, and creative process compared to the aspects of the participation of all interested parties or thorough analysis of all relevant data.

**Figure VI-2: Overall DC effectiveness based on 4 competing values (total ave. of individual score. Peterson, Phillips, Hall & Wooller altogether. various organisations. American & British managers. n=142)**

Here, two important questions should be answered. Firstly, does the perceived effectiveness of DCs vary according to the independent variables mentioned earlier? Lastly but more interestingly, does the tendency of perceived effectiveness of DCs for the 12 evaluation criteria or 4 competing perspectives in decision-making, vary according to those independent variables?

## 6.2. Perceived Effectiveness Differences According to the Variety of Facilitators

Table VI-1 in next page presents the results of 12 analyses of variance used to test for differences across facilitators in the perceived effectiveness of DCs. Null hypothesis of this statistical testing is that the results from the DC conducted by facilitator "A" would be no different from those by facilitator "B". The p-value in column 5, 6, and 7 in table VI-1 summarises very clearly how much agreement there is between the data and *H<sub>0</sub>*. For example, the null hypothesis for Q1 is that there would be no facilitator effects on the perceived effectiveness of DCs with regard to participatory process. The p-value of the Q1 between Phillips and Hall is 0.023. The data provide very little support for *H<sub>0</sub>*; the credibility of *H<sub>0</sub>* is only 2.3%. It also means that if there were no differences in the population means between Phillips and Hall with regard to Q1, the chance of getting such a difference in the sample means (5.28 and 4.75 respectively) is 2.3% or less. So, we could say that as far as the participatory process is concerned, the perceived effectiveness of DCs facilitated by Phillips was better than that of Hall.

As we can see from the table VI-1, the results of statistical analysis show that perceived effectiveness of DCs in decision-making process varied according to facilitators. Overall, p-values show that Peterson dominated other two facilitators in most of the 10 criteria of measuring the effectiveness of DC in aiding group collaborative work. As I mentioned earlier, however, there are limitations in Peterson's data to generalise this finding. In case of Phillips and Hall, the sample DCs were selected randomly by the investigator, whereas the sample conferences of Peterson were chosen by the facilitator himself. He chose samples which he felt to be better performed. So, Peterson's scores may reflect the mean of more successful DCs, whereas Phillips' and Hall's reflect the mean of generally executed DCs. The other possible limitation is that the respondents of Peterson were U.S.A. managers, whereas those of Phillips and Hall were mostly U.K. managers. Thus, the results might reflect national differences as well.

Comparing the results of Phillips with those of Hall, p-values show that managers with Phillips' facilitation perceived the effectiveness of DCs discernibly higher than did managers with Hall's facilitation, with regard to the criteria of Participatory process (Q1), Adaptable process (Q3), Attitudes in terms of challenge and accomplishment (Q9), and Decision quality in terms of the number of alternatives generated (Q11). But, raw data show that Phillips' scores are higher than those of Hall with respect to 10 out of 12 evaluation criteria. Hall's results are slightly higher than those of Phillips in only 2 criteria: Data-based process (Q2), and Legitimacy of decision (=decision acceptance Q4).

**Table VI-1: Results of two sample T-test for measures of the perceived DC effectiveness differences according to facilitators (various co. conducted by Peterson, Phillips & Hall. American + British managers. n = 141)**

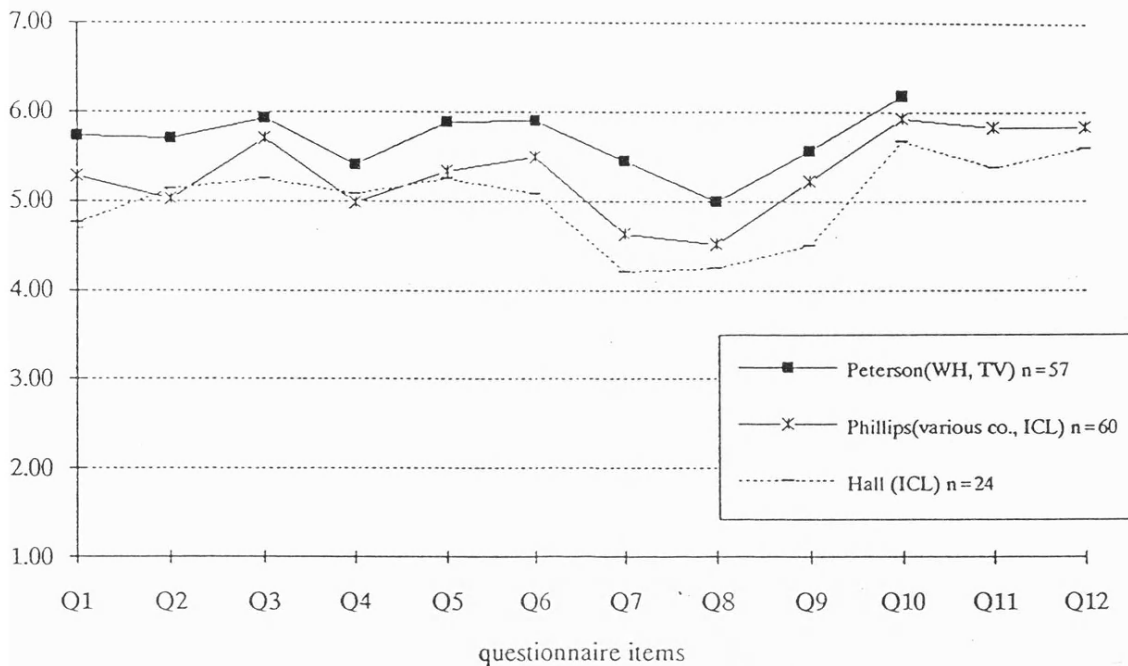
I. Phillips vs. Hall, II. Phillips vs. Peterson, III. Hall vs. Peterson						
Criteria for measures of DC effectiveness	Phillips (n=60)	Hall (n=24)	Peterson (n=57)	P- value		
				Phillips vs. Hall	Phillips vs. Peterson	Hall vs. Peterson
Q1. Participatory Process	5.28	4.75	5.72	0.023**	0.055*	0.0002**
Q2. Data-based Process	5.02	5.13	5.7	0.64	0.0036**	0.015**
Q3. Adaptable Process	5.7	5.25	5.93	0.072*	0.24	0.012**
Q4. Legitimacy of Decision	4.98	5.08	5.4	0.71	0.079*	0.23
Q5. Efficiency of Decision	5.33	5.25	5.88	0.75	0.01**	0.021**
Q6. Goal-centred Process	5.49	5.08	5.9	0.14	0.044**	0.0034**
Q7. Accountability of Decision	4.63	4.21	5.44	0.12	0.0014**	0.0001**
Q8. Supportability of Decision	4.51	4.25	5	0.22	0.036**	0.0036**
Q9. Attitudes: Challenge and Accomplishment	5.22	4.5	5.56	0.01**	0.099*	0.0003**
Q10. Attitudes: Enhancement of Problem-solving Ability	5.92	5.67	6.18	0.25	0.10*	0.017**
Q11. Decision Quality: # of alternatives generated	5.82	5.37	xxx	0.091*	xxx	xxx
Q12. Decision Quality: # of criteria considered	5.83	5.58	xxx	0.23	xxx	xxx

\* : statistically significant to reject null hypothesis with 90% of credibility

\*\* : statistically significant to reject null hypothesis with 95% of credibility

The figure VI-3 below provides a visual representation of the differences in the perceived effectiveness of DCs according to three facilitators more clearly.

**Figure VI-3: Comparison of perceived effectiveness of DCs between facilitators (individual score as a unit of analysis, various organisations. American & British managers. n = 141)**



More importantly, it also depicts the tendency of the perceived effectiveness of DCs for the 12 evaluation criteria (in case of Peterson 10 criteria) according to the facilitators. Table VI-2 below lists the 12 (or 10) criteria in order of the descending ranks based on the scores assigned by the respondents, and compares them according to facilitators. It also summarises the previous section's finding that 12 evaluation criteria could be divided into 3 groups based on the mean values in each criterion.

Figure VI-3 above and table VI-2 below together show that the tendency of the perceived effectiveness of DCs (the order of criteria) was well maintained for most of the 12 criteria irrespective of facilitators. The rankings of evaluation criteria between Peterson and Phillips matches so similarly, especially in the top and the bottom groups of criteria. Hall's order somewhat deviates from Peterson's and Phillips' in the middle range of the ordered criteria; compared to the other two facilitators, Hall was scored relatively higher in Data-based process (Q2) and Legitimacy of decision (Q4), and scored relative lower in Goal-centred process (Q6) and Participatory process (Q1). But, Hall's order also goes along with Peterson's and Phillips' within the top and the bottom ranges of ordered criteria.

**Table VI-2: List of the 12 evaluation criteria in order of the perceived effectiveness**

Criteria	Overall (n=141)	Peterson (n=57)	Phillips (n=60)	Hall (n=24)
Q10. Attitudes: Enhancement of Problem-solving Ability	1 (5.96)	1 (6.18)	1 (5.92)	1 (5.67)
Q12. Decision Quality: # of criteria considered	(5.74)	xxx	(5.83)	(5.58)
Q3. Adaptable Process	2 (5.7)	2 (5.93)	2 (5.7)	2 (5.25)
Q11. Decision Quality: # of alternatives generated	(5.67)	xxx	(5.82)	(5.38)
Q6. Goal-centred Process	3 (5.57)	3 (5.89)	3 (5.49)	5 (5.08)
Q5. Efficiency of Decision	4 (5.53)	4 (5.88)	4 (5.33)	3 (5.25)
Q1. Participatory process	5 (5.37)	5 (5.72)	5 (5.28)	7 (4.75)
Q2. Data-based Process	6 (5.3)	6 (5.7)	7 (5.02)	4 (5.13)
Q9. Attitudes: Challenge and Accomplishment	7 (5.23)	7 (5.56)	6 (5.22)	8 (4.5)
Q4. Legitimacy of Decision	8 (5.16)	9 (5.4)	8 (4.98)	6 (5.08)
Q7. Accountability of Decision	9 (4.88)	8 (5.44)	9 (4.63)	10 (4.21)
Q8. Supportability of Decision	10 (4.66)	10 (5.0)	10 (4.51)	9 (4.25)

Whereas the subjects attending Peterson’s DCs were American managers, those of Phillips and Hall’s were mostly U.K. managers. Facilitators were different from each other in terms of personality, preferred facilitation method, and etc. The client organisations in three data bases represented the various types of industry: computer manufacturing co., university, non-profit social service agency, electronic co., TV co., food manufacturing co. pharmaceutical manufacturing co. and consulting co. The problems treated in DCs differed from each other. Whereas Peterson’s data base was comprised of the more successfully executed cases which had been chosen by the facilitator himself, the data bases of Phillips and Hall were made up with the randomly selected conferences by the investigator.

In spite of these vast differences, the perceived effectiveness of DCs represented consistent patterns for most of the 12 criteria. Especially, the order of evaluation criteria shows almost no difference in the top and the bottom ranges of the ordered criteria. Unlike the orders in the top (highly effective) and bottom (less effective) groups, however, the order in the middle range is shown to be affected by the variety of facilitators.

The high correlation of the ranks of the scores on the 12 (in case of Peterson, 10) evaluation criteria between each two facilitators supports this finding convincingly (see table VI-3 below).

**Table VI-3: Correlation of the ranks of the scores on the 12 (or 10) evaluation criteria (various co. American+ British managers. two-tailed test)**

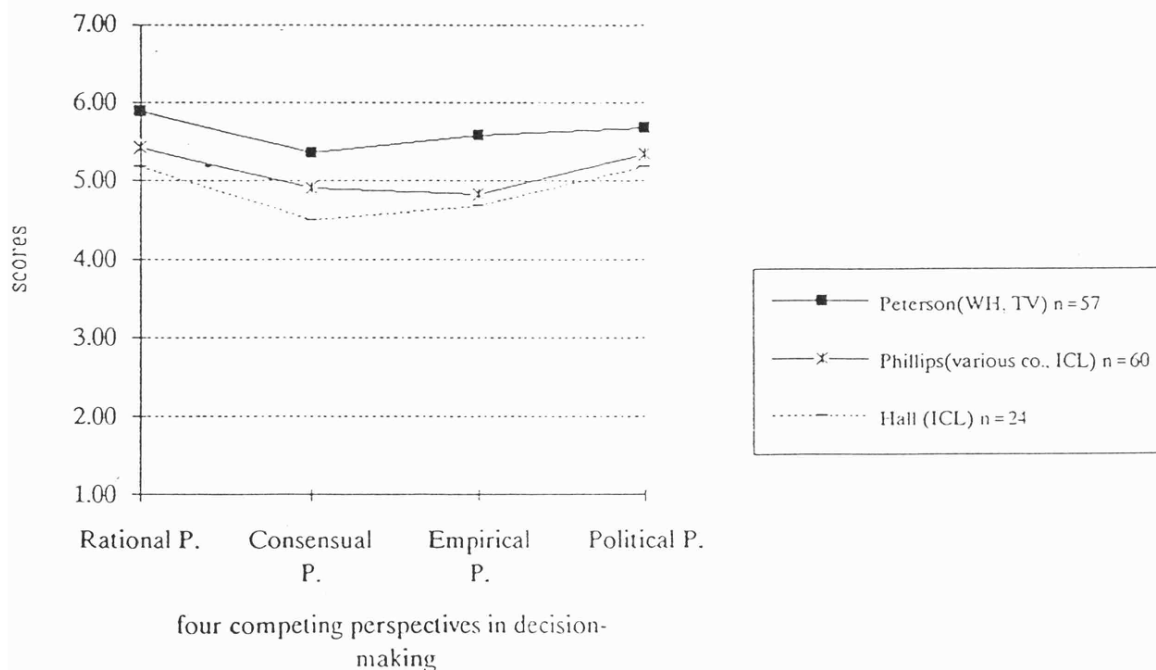
Correlation of Two Facilitators	$r_s$
Peterson (n=57) and Phillips (n=60) on the 10 criteria	0.988****
Peterson (n=57) and Hall (n=24) on the 10 criteria	0.879****
Phillips (n=60) and Hall (n=24) on the 12 criteria	0.895****

$r_s$ : Spearman's rank correlation coefficient

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

This result is also well revealed in figure VI-4 below. Independent of the variety of facilitators, participants generally perceived the aid of DCs more effective in terms of rational and political perspectives of decision-making process, compared to consensual and empirical ones. In other words, participants rated the intervention of DCs as more effective in terms of the logical, rational, flexible, and creative process compared to the aspects of the participation of all interested parties or thorough analysis of all relevant data.

**Figure VI-4: Comparison of DC effectiveness based on 4 competing values between facilitators (individual score as a unit of analysis. various organisations. American & British managers. n=141)**





### 6.3. Organisation Differences

Two main findings of the previous section are (1) the perceived effectiveness of DCs was different from each other according to the variety of facilitators, and (2) the perceived effectiveness of DCs showed consistent patterns for most of the 12 criteria, especially within the top and the bottom ranges of ordered criteria, irrespective of the variety of facilitators.

Now, we test the verification of these findings with more controlled data: (1) two facilitators and the responses from one organisation, and (2) one facilitator and the responses from various organisations.

Firstly, we compare the responses from the attendees of DCs conducted by Phillips with those by Hall, both data were collected from attendees in the same organisation: ICL, a major U.K. based computer manufacturing company. In doing so, we can illuminate possible intrusive effects caused by organisational differences in terms of company cultures, and the type of industry engaged. Lastly, we examine whether perceived effectiveness of DCs varies according to the organisational differences of the respondents. Here, we compare the perception of the effectiveness of DCs between ICL managers and the managers in other organisations, though all were British managers, and facilitated by Phillips. We also compare the perceived DC effectiveness of the managers in Westinghouse with that of managers in TV companies, all were American managers, and facilitated by Peterson.

#### 6.3.1. Two facilitators in one organisation (ICL only)

Table VI-4 below presents the results of 12 analyses of variance used to test for differences across facilitators in ICL managers' perception of the effectiveness of DCs. The results show very similar pictures to the findings of the previous section (see table VI-1) which included the responses of managers from various organisations.

Like the results in table VI-1, the p-values show again Phillips' facilitation was perceived discernibly better than Hall's with regard to the criteria of Participatory process (Q1), Attitudes in terms of challenge and accomplishment (Q9), and Decision quality in terms of the number of alternatives generated (Q11).

**Table VI-4: Results of two sample T-test for measures of perceived DC effectiveness differences according to facilitators (data: ICL. n=45. individual score as a unit of analysis)**

Phillips vs Hall (ICL only)			
Evaluation Criteria	Phillips (n = 21)	Hall (n = 24)	P - value
Q1. Participatory Process	5.76	4.75	0.0008**
Q2. Data-based Process	5	5.13	0.71
Q3. Adaptable Process	5.67	5.25	0.17
Q4. Legitimacy of Decision	5.05	5.08	0.93
Q5. Efficiency of Decision	5.43	5.25	0.63
Q6. Goal-centred Process	5.62	5.08	0.11*
Q7. Accountability of Decision	4.76	4.21	0.071*
Q8. Supportability of Decision	4.33	4.25	0.75
Q9. Attitudes: Challenge and Accomplishment	5.24	4.5	0.033**
Q10. Attitudes: Enhancement of Problem-solving Ability	5.76	5.67	0.74
Q11. Decision Quality: # of alternatives generated	5.86	5.37	0.10*
Q12. Decision Quality: # of criteria considered	5.76	5.58	0.49

\* : statistically significant to reject null hypothesis with 90% of credibility

\*\* : statistically significant to reject null hypothesis with 95% of credibility

Unlike the results of table VI-1. however, the p-value for Adaptable process (Q3) is 0.17, and it is weaker than the respective value (0.072) in table VI-1. But, ICL managers perceived that Phillips' facilitation was discernibly better than Hall's in Goal-centred process (Q6), and Accountability of decision (Q7). Table VI-5 below summarises this findings.

**Table VI-5: List of the evaluation criteria which showed the statistically significant differences between two facilitators (various co. including ICL. British managers. individual score as a unit of analysis)**

Criteria for measures of DC effectiveness	Various co. + ICL			ICL only		
	Phillips (n = 60)	Hall (n = 24)	P - value	Phillips (n = 21)	Hall (n = 24)	P - value
Q1. Participatory Process	5.28	4.75	0.023**	5.76	4.75	0.0008**
Q3. Adaptable Process	5.7	5.25	0.072*	5.67	5.25	0.17
Q6. Goal-centred Process	5.49	5.08	0.14	5.62	5.08	0.11*
Q7. Accountability of Decision	4.63	4.21	0.12	4.76	4.21	0.071*
Q9. Attitudes: Challenge and Accomplishment	5.22	4.5	0.01**	5.24	4.5	0.033**
Q11. Decision Quality: # of alternatives generated	5.82	5.37	0.091*	5.86	5.37	0.10*

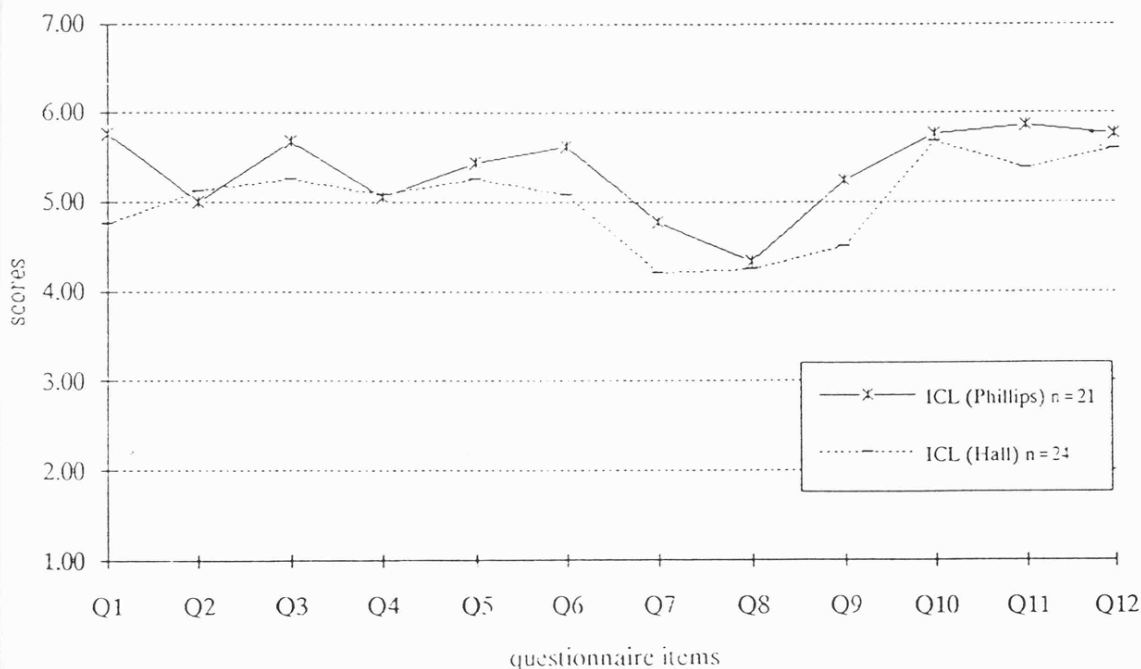
\* : statistically significant to reject null hypothesis with 90% of credibility

\*\* : statistically significant to reject null hypothesis with 95% of credibility

Table VI-5 tells us that independent of organisation differences, managers with Phillips' facilitation rated the effectiveness of DCs discernibly higher than did those with Hall's across at least three criteria: Participatory process (Q1), Attitudes expressed by the degree of challenge and accomplishment (Q9), and Decision quality measured by the number of alternatives generated (Q11). P-values in table VI-5 also show that Phillips' facilitation was perceived moderately better than Hall's with regard to Adaptable process (Q3), Goal-centred process (Q6), and Accountability of decision (Q7). However, identical to the results in the previous section (table VI-1), raw data again show that ICL managers rated Phillips' facilitation higher than Hall's with respect to 10 out of 12 criteria. Hall's facilitation was scored a little bit higher than Phillips' in only 2 criteria: Data-based process (Q2) and Legitimacy of decision (Q4) (see fig.VI-5 below). These results support the first finding of the previous section: the perceived effectiveness of DCs was affected by the variety of facilitators.

The figure VI-5 shows clearly the differences in the perceived effectiveness of DCs between the ICL managers with Phillips' facilitation and those with Hall's facilitation, across 12 evaluation criteria. It also confirms the second finding of the

**Figure VI-5: Comparison of DC effectiveness of ICL managers between facilitators (individual score as a unit of analysis)**



previous section that the pattern of the perceived effectiveness of DCs (rankings of the criteria according to scores) was almost constant for the 12 criteria. Spearman's rank correlation coefficient ( $r_s$ ) in table VI-6 below supports this finding with statistical significance.

**Table VI-6: Correlation of the ranks of the scores on the 12 evaluation criteria (ICL managers only. British managers. two-tailed test)**

Correlation of Two Facilitators	$r_s$
Phillips (n=21) and Hall (n=24)	0.752***

$r_s$ : Spearman's rank correlation coefficient

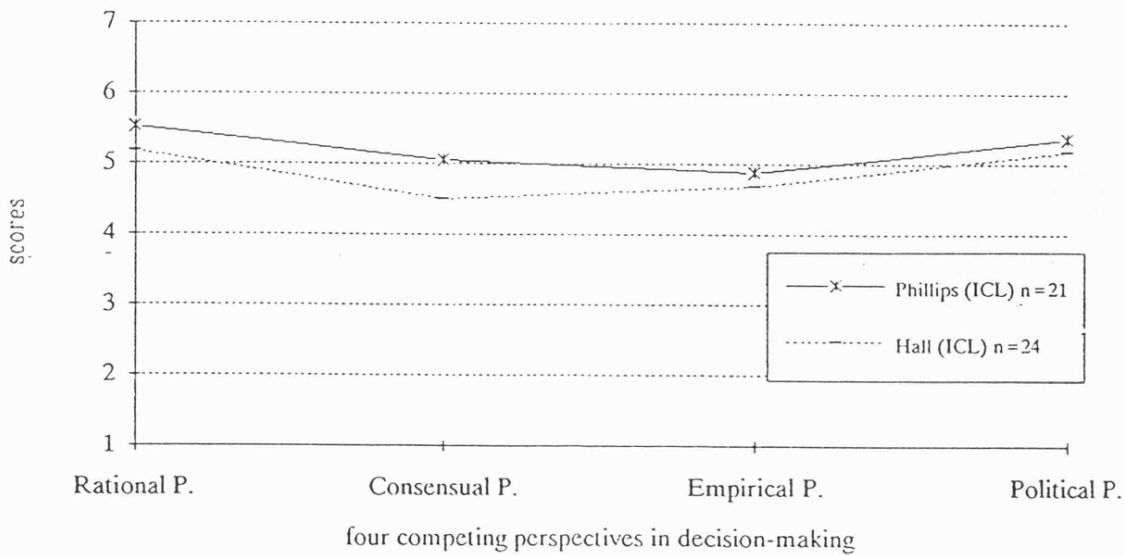
\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 98% significance

Regardless of who facilitated the decision conference, ICL managers generally perceived DCs more effective especially in the criteria of Attitudes toward DCs expressed by the perceived enhancement of problem-solving ability (Q10), Decision quality (both the number of alternatives and criteria generated. Q11, Q12), Adaptable process (Q3), Efficiency of decision (Q5), and Goal-centred process (Q6), but they thought DCs less effective with respect to Supportability of decision (= implementation. Q8), and Accountability of decision (Q7).

Figure VI-5 above reveals an important difference in the perceived effectiveness of DCs between ICL managers with Phillips' facilitation and those with Hall's facilitation: ICL managers perceived Phillips' facilitation was much better than Hall's with regard to Participatory process (Q1). Detailed discussions about this difference are followed in the next section.

Based on the four competing decision-making perspectives, figure VI-6 below compares the differences in the perceived effectiveness of DCs between ICL managers with Phillips' facilitation and those with Hall's facilitation. It shows that Phillips' facilitation was perceived better than Hall's by ICL managers for all of the four perspectives. Figure VI-6 also supports the results of figure VI-2 that participants perceived the aid of DCs more effective with regard to rational and political aspects of decision-making process compared to consensual and empirical ones.

**Figure VI-6: Comparison of DC effectiveness of ICL managers based on 4 competing values between facilitators (individual score as a unit of analysis)**



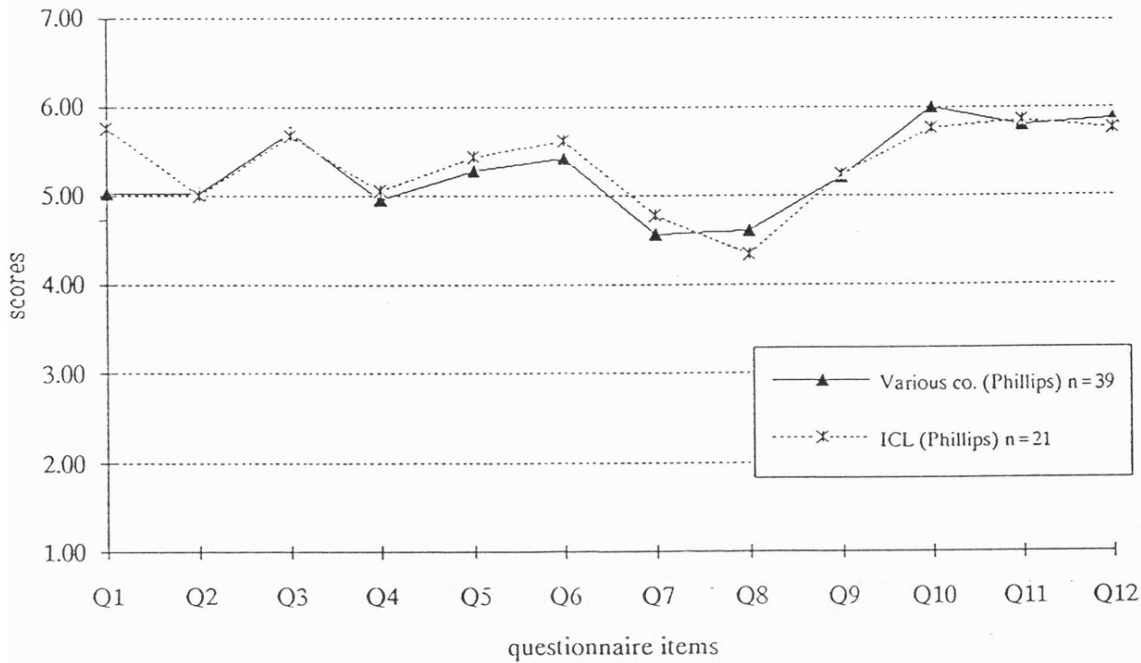
**6.3.2. Same facilitator with various organisations**

The purpose in this section is to test whether the perceived effectiveness of DCs was perceived differently according to organisation differences.

Figure VI-7 below compares the perceived effectiveness of DCs between ICL and other companies’ managers, all were British managers, and facilitated by Phillips. Table VI-7 and figure VI-8 show the comparison of the perceived effectiveness of DCs between Westinghouse and TV industry managers, all were American managers and facilitated by Peterson. In doing so, we can illuminate possible intrusive effects caused by the facilitator differences.

Interestingly, as we see in figure VI-7, under Phillips’ facilitation, there was very little influence of organisational differences on the respondents’ perceptions of the effectiveness of DCs across 11 out of the 12 evaluation criteria, except Participatory process (Q1).

Figure VI-7: Comparison of DC effectiveness between various co. and ICL, both were facilitated by Phillips (individual score as a unit of analysis. British managers)



Similarly, table VI-7 and figure VI-8 below together show that, under Peterson's facilitation, there were little differences between the managers from different industries in their perceptions about the aid of DCs in their decision-making process, with regard to 9 out of 10 evaluation criteria, except Supportability of decision (Q8).

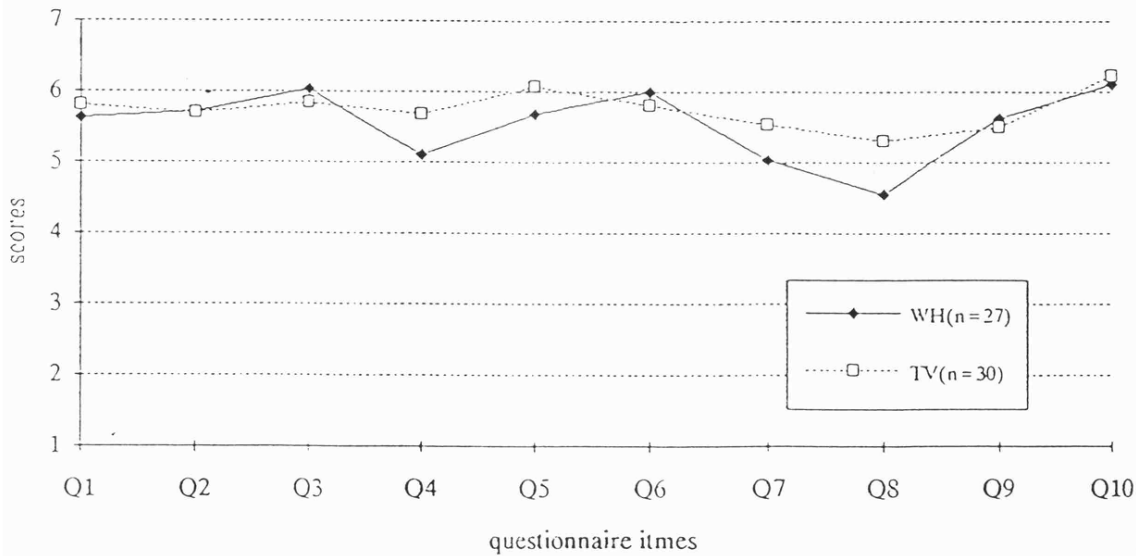
High  $r_s$  (0.826, so with 99% statistical significance) shows that the pattern of perceived effectiveness of DCs by the Westinghouse managers was almost identical to that of TV managers, for the 10 criteria. This again confirms the second finding of the previous section.

**Table VI-7: Results of two sample T-test for measures of the perceived DC effectiveness differences between Westinghouse and TV industry managers, all were facilitated by Peterson (individual score as a unit of analysis. American managers. n = 57)**

Evaluation Criteria	WH (n = 27)	TV (n = 30)	P - value
Q1. Participatory Process	5.63	5.80	0.62
Q2. Data-based Process	5.70	5.70	0.99
Q3. Adaptable Process	6.04	5.83	0.50
Q4. Legitimacy of Decision	5.11	5.67	0.11
Q5. Efficiency of Decision	5.67	6.07	0.17
Q6. Goal-centred Process	6.00	5.80	0.45
Q7. Accountability of Decision	5.04	5.53	0.12
Q8. Supportability of Decision	4.56	5.30	0.039**
Q9. Attitudes: Challenge and Accomplishment	5.63	5.50	0.68
Q10. Attitudes: Enhancement of Problem-solving Ability	6.11	6.23	0.55

\*\* : statistically significant to reject null hypothesis with 95% of credibility

**Figure VI-8: Comparison of DC effectiveness between Westinghouse and TV industry managers, all were facilitated by Peterson (individual score as a unit of analysis. American managers)**



Despite the differences in terms of business areas, organisational cultures, tasks at hand, and etc., two groups of the subjects from different organisations scored so closely each other for most of the 12 (in case of Peterson, 10) criteria to measure the effectiveness of DCs facilitated by Phillips (Peterson), and eventually the perceived effectiveness of DCs showed consistent patterns for the 12 (or 10) evaluation criteria.

Under Peterson’s facilitation, however, there was a discernible difference in the perceived effectiveness of DCs between the managers in TV industry and those from Westinghouse, with regard to Supportability of decision (=implementation Q8). This may be due to the differences in organisational cultures, or compounded effects of other variables. However, as we can see from High  $r_s$  and figure VI-8 above, managers from both industries rated the aid of DCs less effective with respect to Accountability of decision (Q7) and Supportability of decision (Q8) , compared to other evaluation criteria.

The only criterion to show discernible difference under Phillips’ facilitation, is the Participatory process. ICL managers perceived the effectiveness of DCs facilitated by Phillips higher than did those in other organisations with regard to Participatory process (see Q1 in fig. VI-7 earlier). How can we explain the big differences between the two groups of managers from different organisations in their perceived effectiveness of DCs with regard to this criterion? Remember that figure VI-5 earlier also showed that ICL managers perceived Phillips’ facilitation method more effective than Hall’s with regard to Participatory process (Q1). Table VI-8 below rephrases these questions clearly. Under Phillips’ facilitation, the perceived effectiveness of DCs with regard to Participatory process was perceived differently by ICL and other co. managers. ICL managers perceived the Phillips’ facilitation of DCs with regard to this criterion higher than did those in other organisations (mean value 5.76 and 5.03 respectively). ICL managers also perceived that Phillips’ facilitation was more effective than Hall’s with regard to this criterion.

**Table VI-8: Comparison of the perceived effectiveness of DCs with regard to Participatory process (Q1)**

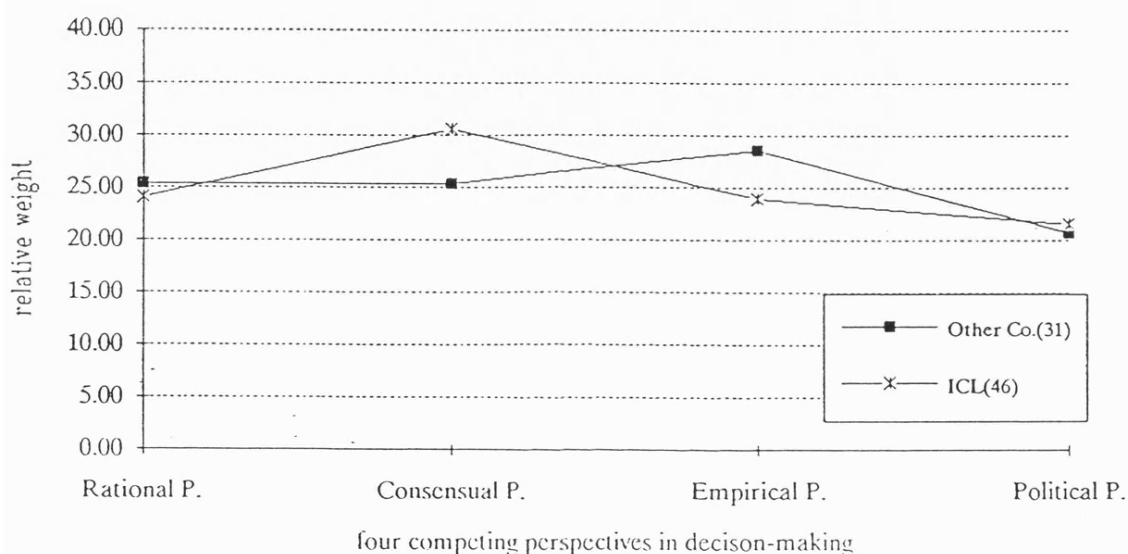
	Phillips	Hall
ICL managers	5.76	4.75
other co. managers	5.03	

This may be due to the compounded effects of the differences in the facilitator’s style and the differences in organisational cultures.



We already saw that unlike the orders in the the top (highly effective) and the bottom (less effective) ranges of ordered criteria, the orders in the middle range of the ranked criteria was found to be affected by the variety of facilitators. The criterion of Participatory process (Q1) is within the middle range of the ranks of the scores on the 12 criteria. Also, figure VI-9 below shows the one aspect of the differences in organisational cultures. Whereas managers in other organisations regarded the empirical perspective as the most important one, ICL managers believed that the consensual perspective was more important than others in decision-making process.

**Figure VI-9: Comparison of the ideal 4 competing decision-making perspectives between ICL and other co. managers (individual score as a unit of analysis)**



Therefore, it might be plausible to conjecture that Phillips' consensus-oriented facilitation method was appreciated more positively by ICL managers than by managers in other organisations, because compared to the managers in other organisations, ICL managers believed that consensual perspective was more important than other three perspectives in decision-making process.

If this conjecture is correct, then, we might say that independent of the variety of facilitators and organisation differences, the rankings of the scores on the evaluation criteria shows almost no differences in the top (highly effective) and the bottom (less effective) ranges. However, the orders in the middle range of the rankings of the criteria was found to be affected by the compounded effects of the variety of facilitators and organisation differences.

### 6.3.3. Summary

(1) Independent of the variety of facilitators, organisational differences, nationality of the subjects, a DC was perceived better than a conventional meeting for all of the 12 (in case of Peterson, 10) criteria to measure the its effectiveness in decision-making process.

(2) The perceived effectiveness of DCs was affected by the variety of facilitators. Independent of organisation differences, statistical analysis shows that managers perceived Phillips' facilitation to be discernibly better than Hall's across at least three criteria: Participatory process (Q1), Attitudes expressed by the degree of challenge and accomplishment (Q9), and Decision quality measured by the number of alternatives generated (Q11). And, p-values also show that Phillips' facilitation was perceived moderately better than Hall's with regard to Adaptable process (Q3), Goal-centred process (Q6), and Accountability of decision (Q7).

(3) Despite the differences in terms of business areas, organisational cultures, tasks at hand, and etc., managers from different industries measured the effectiveness of DCs quite closely each other through most of evaluation criteria, if they were hosted by the same facilitator.

(4) It was found that independent of the variety of facilitators, organisation differences, and nationality of the subjects, the perceived effectiveness of DCs showed consistent patterns throughout most of 12 (or 10) evaluation criteria, especially within the top and the bottom ranges of ordered criteria. But, the orders in the middle range of evaluation criteria was found to be affected by the compounded effects of the differences in the facilitator's style and the differences in organisational cultures.

(5) In general, independent of the variety of facilitators, organisation differences, and nationality of the subjects, the participants perceived the aid of DCs more effective with regard to rational and political aspects of decision-making process compared to consensual and empirical ones, when measuring it based on four competing decision-making perspectives. In other words, participants rated the intervention of DCs more effective in terms of the logical, rational, flexible, and creative process compared to the aspects of the participation of all interested parties and thorough analysis of all relevant data.

## 6.4. Stratum Differences

### 6.4.1. Stratum vs. the perceived effectiveness of DCs

The subjects of the analysis in this section were mostly U.K. managers who had attended DCs conducted by Phillips, Hall, and Wooler. And, there was no single participant at the sample DCs, who regarded his or her stratum as I or VIII.

The rationale to categorise the stratum as II-III, IV-V, and VI-VII for the analysis are explained by table VI-9 below. Table VI-9 shows that Jaques (1989) categorises 8 levels or strata into 4 domains based on the shift in the task requirement. He argues that there is a big shift from operation management domain to general management domain, and even bigger shift from general management domain to corporate strategic domain in terms of the degree of abstraction of the task requirement managers find themselves with.

As we saw before, Phillips (1984a) argues that a decision support system for top managers must be particularly good at aiding discretionary activity. He, then, claims that a DC which consists of problem owners, computer systems, and specialist facilitators, is one type of decision support for top managers.

If Phillips' and Jaques' articulations are both correct, then the perceived effectiveness of DCs should become higher as one climbs the stratum. Also, the differences in the perceived effectiveness of DCs between stratum IV-V (corporate strategic) and VI-VII (general management) managers should be bigger than those between stratum II-III and IV-V (operation management) managers.

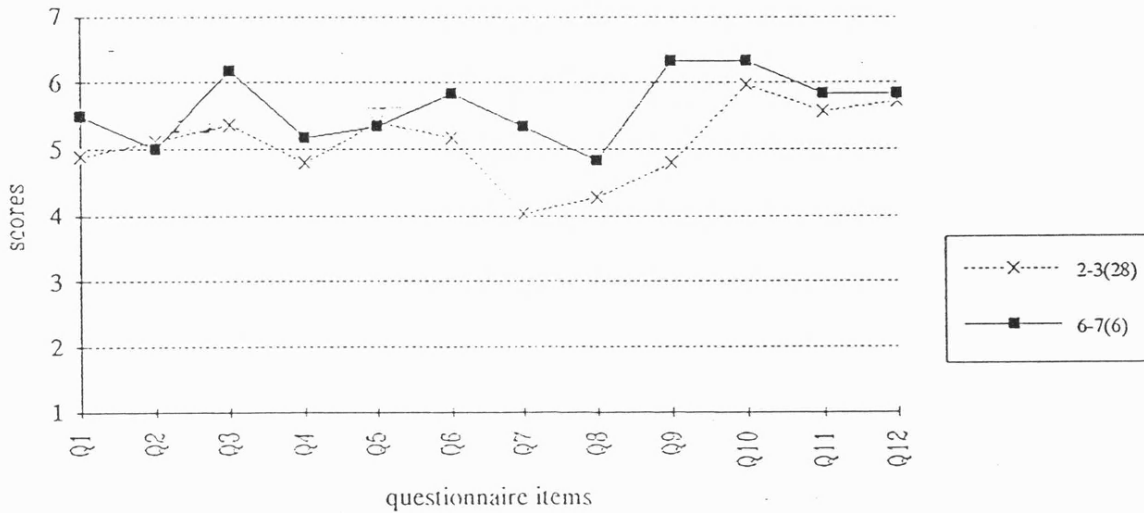
**Table VI-9: Stratum categorised by the four work domains (Jaques, 1989)**

Stratum	Work Domain	Degree of abstraction of the task requirement
VIII	Corporate Strategic Domain	The shift to stratum VI is experienced by senior executives as <b>the biggest change in their careers</b> . They become the overseer of stratum V managers who still have "real projects" as compared with the very abstract "conceptual programs" they now find themselves with.
VII		
VI		
V	General Management Domain	Once managers move from Stratum III to IV, <b>the level of abstraction takes a sharp leap</b> . It changes from what people experience at the concrete level to a more general level of abstraction.
IV		
III	Operation Management Domain	The work is still at a concrete level of abstraction, in the sense that it is possible to observe everything that is going on, by directly scanning the whole.
II		
I	Direct Hands-On Work Domain	The domain of direct concrete hands-on operator/clerical work. There are no true managers in this stratum.

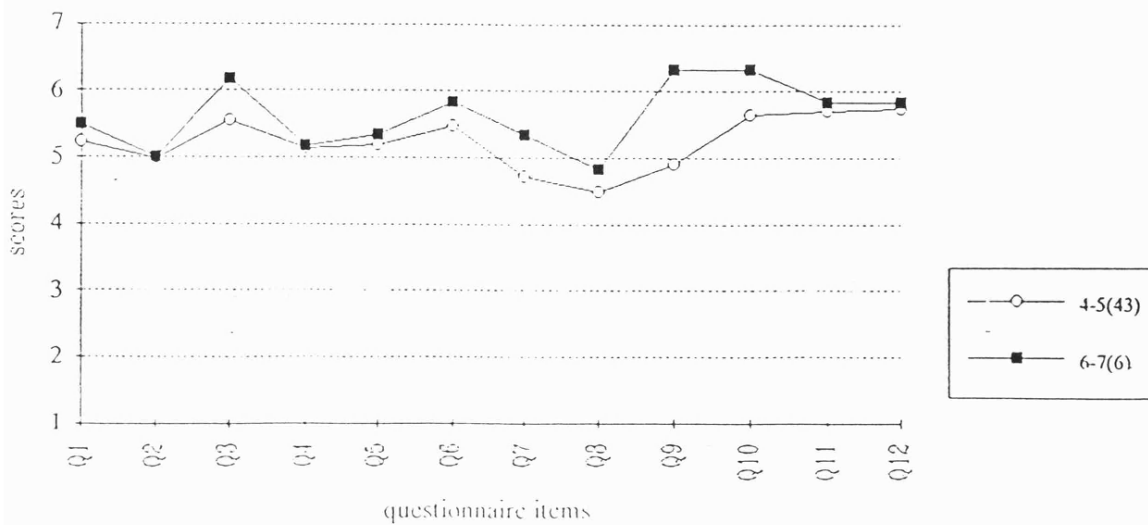
Figure VI-10, VI-11, and VI-12 below present clearly the differences in the perceived effectiveness of DCs according to participants' strata.

Overall, the perceived effectiveness of DCs is greater at higher levels in the executive hierarchy.

**Figure VI-10: Comparison of DC effectiveness between strata II-III and VI-VII managers**  
 (individual score as a unit of analysis. various co. + ICL. Phillips, Hall & Wooler.  
 British managers. n = 34)



**Figure VI-11: Comparison of DC effectiveness between strata IV-V and VI-VII managers**  
 (individual score as a unit of analysis. various co. + ICL. Phillips, Hall & Wooler.  
 British managers. n = 49)



**Figure VI-12: Comparison of DC effectiveness between strata II-III and IV-V managers**  
 (individual score as a unit of analysis. various co.+ICL. Phillips, Hall & Wooler.  
 British managers. n=71)

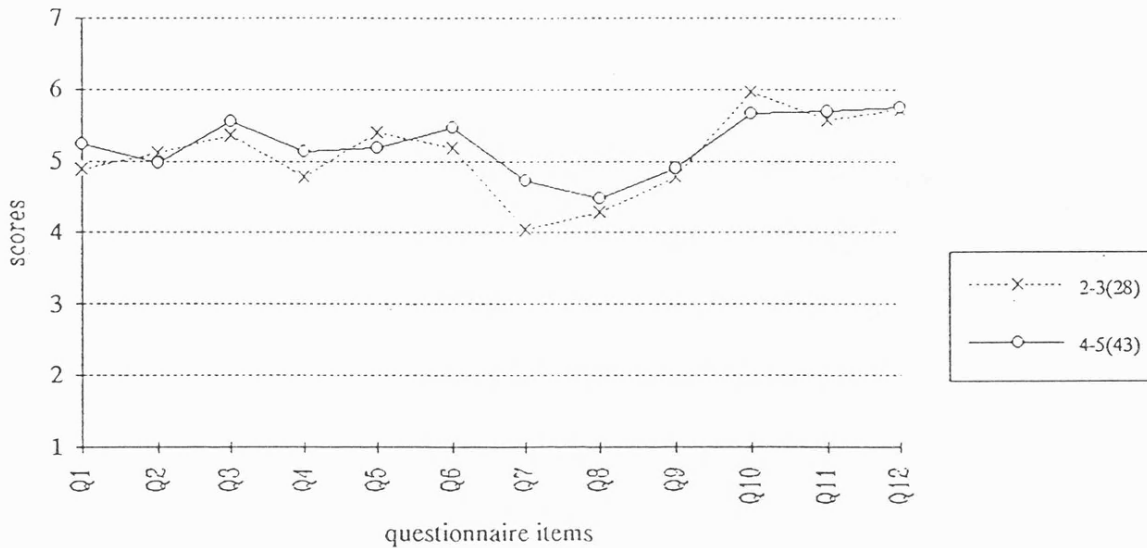


Table VI-10 in next page presents the mean values of the perceived effectiveness of DCs, and the results of statistical analysis for measures of differences in the perceived effectiveness of DCs according to strata II-III, IV-V, and VI-VII managers.

Figure VI-10 and table VI-10 together show that the mean values of the perceived DC effectiveness of strata VI-VII managers are higher than those of strata II-III managers with regard to 10 out of 12 evaluation criteria. Especially, p-values indicate that they show distinctive differences in Adaptable process (Q3), Goal-centred process (Q6), Accountability of decision (Q7), and Attitudes (challenge and accomplishment Q9). However, the perceived effectiveness of strata VI-VII executives is almost same level to that of strata II-III managers with regard to Data-based process (Q2), Efficiency of decision (Q5), and Decision quality (the number of criteria considered Q12).

Simialry, figure VI-11 and table VI-10 show that the mean values of the perceived DC effectiveness of strata VI-VII managers are higher than those of strata IV-V managers with regard to 10 out of 12 evaluation criteria. Especially, p-values indicate that they show distinctive differences in Adaptable process (Q3), Attitudes in terms of challenge and accomplishment, and perceived enhancement of problem-solving ability (Q9, Q10). However, the perceived effectiveness of strata VI-VII executives shows

almost the same level with that of strata IV-V managers with regard to Data-based process (Q2), and Legitimacy of decision (Q4), Efficiency of decision (Q5), and Decision quality: the number of alternatives and criteria generated (Q11, Q12).

Figure VI-12 and table VI-100 show that the mean scores of the perceived DC effectiveness by strata IV-V managers are higher than those of strata II-III managers with regard to 9 out of 12 evaluation criteria. Especially, p-values indicate that they show distinctive differences in Accountability of decision (Q7). But, the perceived effectiveness of strata IV-V managers is similar to, or slightly lower than that of strata II-III managers with regard to Data-based process (Q2), Efficiency of decision (Q5), Attitudes (challenge and accomplishment Q9), and Decision quality: the number of alternatives and criteria generated (Q11, Q12).

**Table VI-10: Results of two sample T-test for measures of perceived DC effectiveness differences according to strata (various co.+ICL managers. conducted by Phillips, Hall and Wooler. individual score as a unit of analysis)**

I., II., & III. Strata 2-3 vs 4-5, 2-3 vs 6-7, and 4-5 vs 6-7				P-value		
Evaluation Criteria	Str 2-3	Str 4-5	Str 6-7	Strata	Strata	Strata
	(n=28)	(n=43)	(n=6)	2-3 vs. 4-5	2-3 vs. 6-7	4-5 vs. 6-7
Q1. Participatory Process	4.89	5.23	5.5	0.19	0.15	0.51
Q2. Data-based Process	5.11	4.98	5	0.63	0.85	0.97
Q3. Adaptable Process	5.36	5.56	6.17	0.42	0.053*	0.11*
Q4. Legitimacy of Decision	4.79	5.14	5.17	0.22	0.60	0.97
Q5. Efficiency of Decision	5.39	5.19	5.33	0.45	0.88	0.71
Q6. Goal-centred Process	5.18	5.47	5.83	0.32	0.11*	0.33
Q7. Accountability of Decision	4.04	4.72	5.33	0.017**	0.047**	0.29
Q8. Supportability of Decision	4.29	4.49	4.83	0.36	0.32	0.52
Q9. Attitudes: Challenge and Accomplishment	4.79	4.91	6.33	0.67	0.00**	0.00**
Q10. Attitudes: Enhancement of Problem-solving Ability	5.96	5.65	6.33	0.17	0.19	0.024**
Q11. Decision Quality: # of alternatives generated	5.57	5.7	5.83	0.62	0.50	0.70
Q12. Decision Quality: # of criteria considered	5.71	5.74	5.83	0.89	0.82	0.86

\* : statistically significant to reject null hypothesis with 90% credibility

\*\* : statistically significant to reject null hypothesis with 95% credibility

Considering the results of T-test and raw data together, we may summarise our findings as follows:

- (1) Overall, the perceived effectiveness of DCs was greater at higher levels in the executive hierarchy.
- (2) Even though raw data show that in general, the perceptions of strata IV-V managers were higher than those in strata II-III, the difference itself was not so significant for the 12 criteria except Accountability of decision (Q7). Also, the differences in the perceived effectiveness of DCs between strata VI-VII (corporate strategic) and IV-V (general management) managers were relatively bigger than those between strata IV-V and II-III (operation management) managers for most of the 12 evaluation criteria.
- (3) Compared to the managers in strata II-III and IV-V, strata VI-VII executives considered a DC significantly effective with regard to Attitudes (challenge and accomplishment Q9), and Adaptable process (Q3). Respective p-values in table VI-10 support this finding very well.
- (4) There were little differences in the perceived effectiveness of DCs between different strata managers with regard to Data-based process (Q2), Efficiency of decision (Q5), and Decision quality in terms of the number of alternatives and criteria considered (Q11, Q12).
- (5) The perceived effectiveness of DCs across 12 criteria was consistent irrespective of the respondent's stratum differences. The high correlation between the two groups of rankings of the scores on the 12 criteria obtained from the managers in different strata supports this finding with statistical significance (see table VI-11 below).

**Table VI-11: Correlation of the ranks of the scores on the 12 evaluation criteria (under the facilitation of Phillips, Hall and Wooler together. various co.+ ICL. British managers. two-tailed test)**

Correlation of Two Strata	$r_s$
Strata II-III (n=28) and Strata IV-V (n=43)	0.897****
Strata II-III (n=28) and Strata VI-VII (n=6)	0.529*
Strata IV-V (n=43) and Strata VI-VII (n=6)	0.583*

$r_s$ : Spearman's rank correlation coefficient

\*: reject the null hypothesis that there is no association between the rank pairs with 90% significance

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

Remember, in previous sections, we found that independent of the variety of facilitators, organisation differences, and nationality of the subjects, the perceived effectiveness of DCs also represented consistently same patterns with the present one for the 12 criteria.

Overall, the results support the Phillips' and Jaques' articulations: the perceived effectiveness of DCs is greater at higher levels of the executive hierarchy. The differences in the perceived DC effectiveness between strata VI-VII (corporate strategic) and IV-V (general management) managers are bigger than those between strata IV-V and II-III (operation management) managers.

Why did the managers in higher strata perceive the effectiveness of DCs higher than did those in lower strata? Although some of the main reasons for this question were partly mentioned in the previous chapter, however, more discussions are followed.

Theory (Jaques, 1976; 1982; 1989) argues that the degree of abstraction of the work becomes greater as one climbs the executive hierarchy. Especially, the shift in the degree of abstraction takes a sharp leap when managers move from stratum III to IV, and it also takes the biggest leap in their careers when they move from stratum V to VI. Phillips puts this change as the shift from more "rule-based" to more "discretionary work." And, Jaques puts it as the shift from "real projects" to "conceptual programs." Phillips (1984a) argues that this qualitative shift in the task requirements demands senior managers to rely much more heavily on judgement and intuition. In addition, they need to deal with a variety of problems of different structural types. In his study of a dozen successful top managers' thought processes, Isenberg (1984) provides two supportive findings for Phillips' argument above. First, top managers' thinking deals not with isolated and discrete items but with portfolios of problems, issues, and opportunities in which many problems are interrelated and exist simultaneously. Second, senior executives do use intuition during all phases of the problem-solving process: problem finding, problem defining, generating and choosing a solution, and implementing the solution. Here, intuition is not the opposite of rationality, nor is it a random process of guessing. Rather, it is based on extensive experience both in analysis and problem solving and in implementation, and to the extent that the lessons of experience are logical and well-founded, then so is the intuition. Further, managers often combine gut feel with systematic analysis, quantified data, and thoughtfulness. Mintzberg (1973), from his study of five American chief executives, points out that executives identify decision situations and build interpretations of their environments not with the aggregated, historical abstractions a formal MIS provides but with specific titbits of informal, soft information especially gossip, hearsay, and speculation.

Two pilot studies of DC processes carried out DAU at L.S.E. support this stratum-specific differences empirically. Chun (1988a) shows that there is a shift in the relative weighting between "hard" and "soft" objectives as one moves to higher levels in the



organisation. "Hard" criteria include profit, revenue growth, cost reduction; "soft" criteria represent future potential, risk, synergy, flexibility, innovativeness. Executives at stratum VI, placed relative weight of about 60% on soft criteria, with the other 40% on hard criteria. For general managers at stratum IV, the percentages were roughly reversed. Similarly, the higher stratum managers showed more concern for future potential than short-term financial goals, whereas the concerns of lower-stratum managers were reversed. Here, "hard" objectives including short-term financial goals can be regarded as the "visible", and they correspond well to Phillips' "rule-based work" and Jaques' "real projects," whereas "soft" objectives including future potential can be thought as the "invisible", and they match well to Phillips' "discretionary work" and Jaques' "abstract conceptual programs." Similarly, Oldfield and Wooler (1988) report that higher stratum managers were more abstract in their problem handling, generated more novel options and took into account long term perspectives more frequently, proposed more strategic issues than lower stratum managers. As Isenberg (1985) described, the top executive thought processes can be characterised as highly inferential, intuitive, and opportunistic (small amounts of data combined with assumptions, experiences, and knowledge).

Therefore, Chorafas (1988) addresses that decision support systems cannot and should not be designed the same way for the different levels of the organisation. Stratification is important as each level has its own requirements. To help these senior managers, Phillips (1984a) asserts that a decision support system for top managers must be particularly good at aiding discretionary activity that is highly inferential and intuitive. To achieve this purpose, he (1984a; 1988) proposes that a system must have three main parts: decision makers and major problem owners, computer systems, and specialist facilitators. Computer modelling is used to put together all the pieces of the problem in one framework and to show the problem owners the implications of their judgements. The facilitator provides the flexibility that is needed to represent the different aspects of the problem with different structures. The problem owners contribute the vital ingredient: content. Phillips (1984a) states that it is the integration of these three elements which is needed for true decision support for top executives. And, he claims that DC which consists of these three elements, is one type of decision support for top managers. It seems to me that the end product of the integration of these three elements is the requisite model (Phillips, 1982; 1984b) of the task at senior executives' hands. And, this requisite model is the *satisficingly* (finding the best stage as opposed to a merely satisfactory one (Simon, 1976; Janis & Mann, 1977)) visualised version of their abstract, and conceptual tasks.

It may be natural to assume that because of the increased degree of abstractions in their tasks, higher stratum managers may want more to visualise their "invisible" (abstract and conceptual) problems. In fact, based on his two year observations of a dozen successful top managers' thinking processes, Isenberg (1984) found that the successful top managers showed an ability to tolerate and even thrive on high degrees of ambiguity and apparent inconsistency.

Two empirical studies of DC processes carried out at DAU, L.S.E. strongly support this conjecture. Wooler (1987) found that senior executives (stratum VI) twice as frequently restructure a model once they have seen the initial results than do general managers (stratum IV). The latter confine revisions to changing evaluations of options on criteria or to changing weight on criteria, i.e., they stay within the initially established structure more than senior executives. Chun (1988a) confirmed this finding that higher stratum managers more frequently restructure the models. Because their problems are more invisible, I think, senior executives frequently restructure the models than do lower stratum managers. During their restructuring processes, senior executives gradually put their abstract and conceptual ideas into the real form. Therefore, they appreciate the effectiveness of a DC highly than do lower stratum managers. I think that the main advantage of a DC is to help senior managers to see their conceptual problems with their own eyes.

The two main parts of a DC mentioned earlier help senior executives to explicate their abstract problems. Facilitators help the problem owners to formulate and structure the problems, express preferences and make judgements in quantitative form, that is to build the model for their problems. This model incorporates the differing perspectives of participants, and more importantly provides the "visualised" version of their conceptual problems. Then, computer systems are used to facilitate modelling of the problem and sensitivity analysis . Through on-the-spot creation of a computer-based model and sensitivity analysis, managers can examine the implications of the decision model, modify it, and test the effects of different assumptions. Thereby they not only rule out ineffective strategies and focus quickly on primary issues of major impact, but also develop a shared understanding of the problem and are helped to reach agreement about what to do.

This explanation is supported by the current findings that compared to the managers in strata II-III, and IV-V, strata VI-VII executives considered a DC significantly effective with regard to Adaptable process (O3), and Attitudes: challenge and accomplishment (O9).

This study may be the first attempt to examine empirically the effects of users' stratum differences on their perceived effectiveness of a GDSS; it empirically shows that managers in different levels perceive the effectiveness of a GDSS differently. Here, the perceived effectiveness of DCs is greater at higher levels in the executive hierarchy. Therefore, before claiming the benefits of GDSSs in general, it is necessary for us to investigate carefully what stratum managers our systems are intended for. The generalisations about the effectiveness of a GDSS could be limited by the users' stratum differences as well.

#### **6.4.2. Stratum vs. ideal four competing decision-making perspectives**

As we saw before, Jaques (1989) reveals one particular category of task demands specific to each organisational stratum. Rohrbaugh (1989) then, links it directly to one or two of the four competing decision-making perspectives.

In brief, the complexity of lower level tasks (stratum II-III: operation management domain) requires managers to accumulate and diagnose data, and to construct alternative routes to goals. So, empirical and rational (but, mainly empirical) decision-making perspectives are appropriate to meet these levels of task complexity. The complexity of middle level tasks(stratum IV-V: general management domain) requires managers to parallel process several interacting projects, to make trade-offs between tasks, and to sense interconnections between the variables in the organisation and the environment. So, rational and political (but, mainly rational) decision-making perspectives may be more required to meet this kind of task complexity. The complexity of higher level task (stratum VI-VII: corporate strategic domain) requires managers to coordinate the systems, to provide business direction, to contribute to strategic thinking at corporate level, to plan and organise the work in relation to societal development, and to develop alternative world-wide strategic plans. So, political and consensual (but, mainly political) decision-making perspectives may cope well with this type of task complexity.

Table VI-12 below shows clearly the relationships between the stratum, the appropriate decision-making perspective(s) for each stratum, and the corresponding problem-solving style.

**Table VI-12: Match between Stratified Systems Theory, Competing Values Approach, and Jung's Information Processing Model**

Stratum	Management Domain	Rohrbaugh's 4 Competing Decision-making Perspectives	Jung's Human Problem-solving Style
VII	Corporate strategic	Political and Consensual	Intuition and Feel
VI		Political perspective	Intuition (gathering)
V	General management	Rational and Political	Intuition and Think
IV		Rational perspective	Think (evaluation)
III	Operational management	Empirical and Rational	Sensation and Think
II		Empirical perspective	Sensation (gathering)

Rational perspective: logical, rational process

Consensual perspective: participation of all interested parties

Empirical perspective: thorough analysis of all relevant data

Political perspective: flexible, creative process

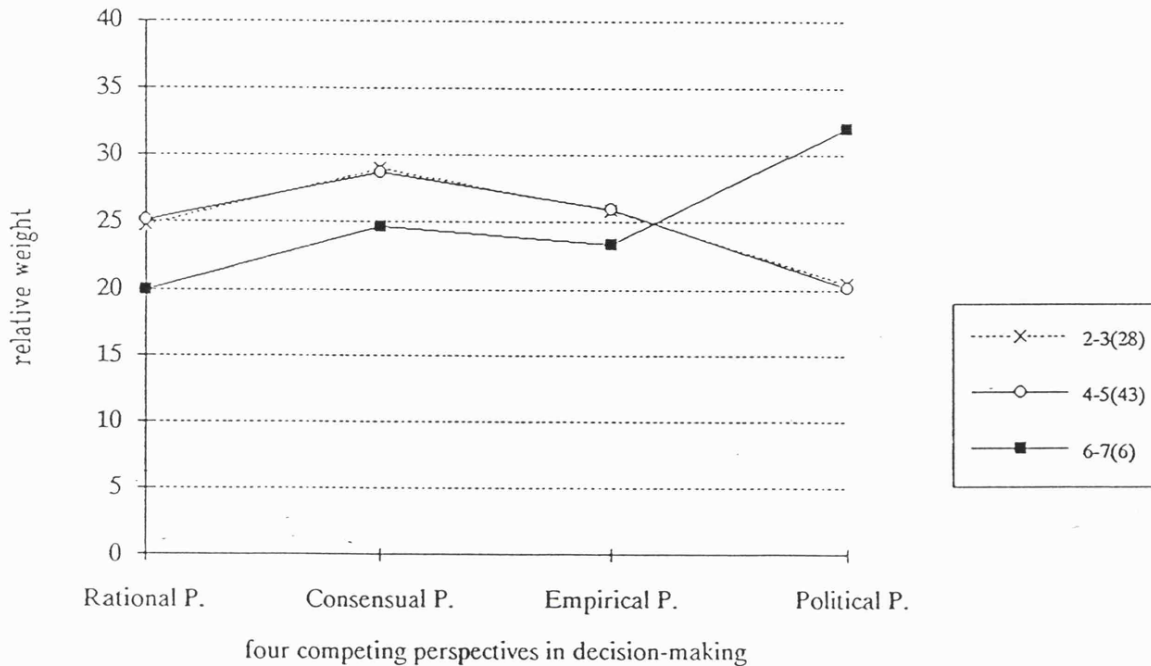
For example, stratum VI executives must deal with social and theoretical systems as entities, and judgement is exercised in coordinating these systems, in developing groups of strategically related businesses, in providing business direction and in contributing to strategic thinking at corporate level (Phillips & Jaques, 1983). This characteristic of the task makes the political perspective the most important one out of four competing decision-making perspectives for executives at this level (Rohrbaugh, 1989). Then, theoretically it would mean that Intuition type people may be more appropriate than Sensation type people to manage well the task requirement of this level.

Do real managers show these hypothetical relationship between task characteristics and four competing decision-making value perspectives? I asked the subjects to allocate 100 points among the four decision-making perspectives to show the relative importance of the perspectives to them. The subjects of this analysis were mostly U.K. managers who attended decision conferencings conducted by Phillips, Hall, and Wooler. There was no single respondent who regarded his or her stratum as I or VIII. The rationale to categorise the strata as II-III, IV-V, and VI-VII for the analysis was explained before.

Figure VI-13 below compares the ideal 4 decision-making perspectives between different strata managers. It is surprising to note that there is almost no difference with regard to four ideal decision-making perspectives between strata II-III and IV-V

managers. P-values in table III-4-5 also strongly support this finding (0.86 for rational, 0.92 for consensual, 0.96 for empirical, and 0.9 for political perspective).

Figure VI-13: Stratum vs. the ideal 4 competing decision-making perspectives  
 (individual score as a unit of analysis. various co.+ICL.  
 British managers. Phillips, Hall & Wooler. n=77)



Theory argues that the empirical and rational perspectives are more important than the others to deal with the characteristics of the task in strata II-III and IV-V managers. It also tells us that consensual perspective is the opposite end from the rational perspective. Contrary to the theoretical articulations, real managers in those levels rated the consensual perspective (scored 29) to be more important than the empirical (scored 26) or rational (scored 25) perspective. But, as expected, they considered the political perspective (scored 20) to be the least important among four perspectives. Theory also states that the political and consensual perspectives are more crucial than the other two perspectives to manage the task requirements in strata VI-VII management level. Consistent with the theoretical arguments, real executives in these levels rated the political perspective (scored 32) to be the most important one, then consensual (scored 24.7), empirical (scored 23.3), and considered the rational perspective (scored 20) to be the least important among four perspectives.

Figure VI-13 above and p-values in table VI-13 also show that unlike other perspectives, the importance of political perspective in decision-making takes a sharp leap when managers move into stratum VI.

**Table VI-13: Results of two sample T-test for measures of managers' ideal 4 competing decision-making perspectives according to strata (various co.+ ICL. British managers. Phillips, Hall and Wooler. individual score as a unit of analysis)**

I. Stratum 2-3 vs 4-5, II. 2-3 vs 6-7, III. 4-5 vs 6-7,				P-value		
Four Competing Decision-making Perspectives	Strata 2-3 (n=28)	Strata 4-5 (n=43)	Strata 6-7 (n=6)	Strata 2-3 vs 4-5	Strata 2-3 vs 6-7	Strata 4-5 vs 6-7
IDEAL Rational Perspective	24.7	25.2	20	0.86	0.26	0.21
IDEAL Consensual Perspective	29	28.7	24.7	0.92	0.40	0.43
IDEAL Empirical Perspective	25.9	26	23.3	0.96	0.59	0.56
IDEAL Political Perspective	20.5	20.1	32	0.9	0.0074**	0.0064**

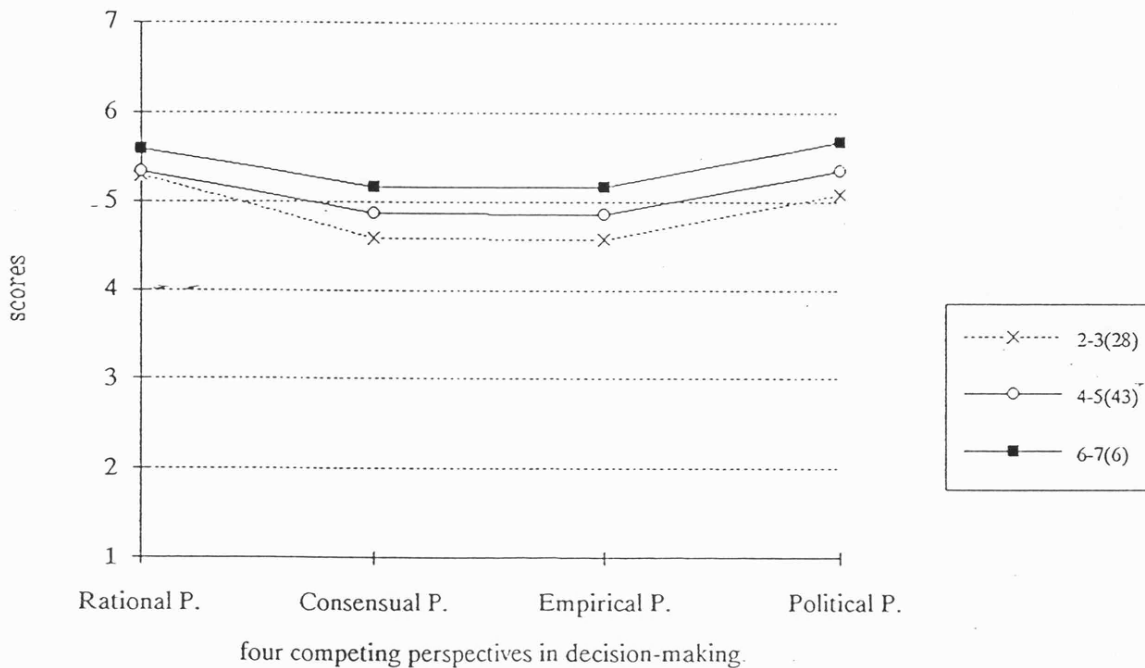
\*\* : statistically significant to reject null hypothesis with 99% credibility

In brief, empirical data show that:

- (1) unlike theoretical arguments, strata II-III and IV-V managers show almost no difference with regard to their four ideal decision-making perspectives,
- (2) contrary to the theoretical articulations, real managers in strata II-III and IV-V rated the consensual perspective to be more important than the empirical or rational perspective. But, as expected, they considered the political perspective to be the least important among the four perspectives,
- (3) executives in strata VI-VII rated the political perspective be the most important one, then consensual, empirical, and considered the rational perspective be the least important among the four perspectives. This finding is consistent with the theoretical articulations, and
- (4) unlike other perspectives, the importance of the political perspective in decision-making took a sharp leap when managers moved into stratum VI. The results of statistical analysis (p-value) also strongly support this finding.

Next, the perceived effectiveness of DCs is examined based on four competing decision-making perspectives. Figure VI-14 and table VI-14 below show us interesting findings. The perceived effectiveness of DCs becomes greater for all of the four perspectives at higher levels of the executive hierarchy. But, the pattern of perceived effectiveness looks consistent independent of respondents' stratum differences: managers in all levels rated DCs relatively more effective in terms of the rational and the political perspectives compared to the consensual and the empirical ones.

**Figure VI-14: Stratum vs. perceived DC effectiveness based on 4 competing values**  
 (individual score as a unit of analysis. various co.+ICL. Phillips, Hall & Wooler. n=77)



**Table VI-14: Stratum vs. perceived DC effectiveness differences based on 4 competing decision-making perspectives (individual score as a unit of analysis. various co.+ICL. British managers. Phillips, Hall and Wooler)**

Four competing decision-making perspective	Stratum II-III (n=28)	Stratum IV-V (n=43)	Stratum VI-VII (n=6)
Rational Perspective (ave. of Q5 and Q6)	5.29	5.33	5.58
Consensual Perspective (ave. of Q1 and Q8)	4.59	4.86	5.17
Empirical Perspective (ave. of Q2 and Q7)	4.57	4.85	5.17
Political Perspective (ave. of Q3 and Q4)	5.07	5.35	5.67

This confirms the finding of previous section: in general, the participants perceived the aid of DCs more effective with regard to rational and political aspects of decision-making process compared to consensual and empirical ones, when measuring it based on four competing decision-making perspectives. As we saw before, the rational and political perspectives are appropriate to the characteristics of task in stratum IV, V, VI, and VII managers (see table VI-12 earlier). So, we might say that decision conferencing can provide first-rate support especially for stratum IV, V, VI, and VII managers.

The results in this section support Phillips' arguments (1984a) empirically. Those are (1) true GDSSs for top managers require the services of facilitators for "visualising" conceptual problems, (2) before designing GDSS, we need to understand the underlying stratified structure of organisations and the way in which the mix between discretionary and rule-based activity changes significantly when moving between strata, (3) in this sense, decision conferencing can provide valued support for top managers, especially for stratum IV, V, VI, and VII executives..

### 6.4.3. Summary

(1) The results empirically support the articulations of Phillips (1984a) as well as Jaques (1989): the perceived effectiveness of DCs became greater at higher levels in the executive hierarchy. Also, the differences in the perceived effectiveness of DCs between strata VI-VII (corporate strategic) and IV-V (general management) managers were bigger than those between strata IV-V and II-III (operation management) managers.

(2) Unlike theoretical arguments, however, strata II-III and IV-V managers showed almost no differences with regard to their ideal decision-making perspectives. Furthermore, contrary to the theoretical articulations, managers in strata II-III and IV-V rated the consensual perspective to be more important than the empirical or rational perspective. But, as expected, they considered the political perspective to be the least important among the four perspectives. Executives in strata VI-VII regarded the political perspective to be the most important one, then consensual, empirical, and considered the rational perspective to be the least important among the four perspectives. This finding is consistent with the theoretical articulations. Of greater interest, however, is the finding that unlike other perspectives, the importance of political perspective in decision-making took a sharp leap when managers moved into stratum VI.

(3) Like the results in previous sections, the perceived effectiveness of DCs across 12 evaluation criteria showed consistent patterns irrespective of the differences in respondents' stratum; Spearman's rank correlation coefficient of the two groups' rankings of the scores on the 12 criteria obtained from the managers in different strata supports this finding with statistical significance (see table VI-11 earlier).

(4) Previous DC studies (Wooler, 1987; Chun 1988a; Oldfield & Wooler, 1988) show that management strata determine the extent to which decision problems are explored



and structured and therefore affect the decision-making process and possible solutions. They also suggest that information and thus group decision support systems requirements are different for each stratum of management. Thus, it is important in developing a GDSS to identify how each stratum handles decision problems. This study shows that managers in different levels perceive the effectiveness of a GDSS differently.

These series of empirical studies carried out DAU at L.S.E. suggest GDSS researchers two important areas to be investigated: one is that before designing a GDSS, we need to understand the underlying stratified structure of organisations and the way in which the mix between discretionary and rule-based activity changes significantly when moving between strata (Phillips, 1984a), and the other is that before claiming the benefits of GDSS in general, it is necessary for us to investigate carefully what stratum managers our systems are intended for. The general findings about the effectiveness of a GDSS could be limited by the users' stratum differences as well.

## **6.5. Group Size**

The increasingly complex and turbulent business environments of these days frequently require specialised domain knowledge and skills pertaining to the issues, which are usually beyond that of the most knowledgeable or skilled person. Groups tend to bring together different facets or domain of knowledge that cumulatively yield a comprehensive picture of a complex area exceeding the capabilities of any individual group member (Nunamaker et al., 1988). So, people are convened in a group to tackle those complex problems.

### **6.5.1. Previous research on group size**

#### **(1) Group dynamics research**

Many group dynamics researchers have reported that group size can have an impact upon interaction patterns: there may be negative as well as positive consequences as membership increases (Bales & Borgatta, 1955; Hoffman, 1979; Shaw, 1981).

##### **(i) Positive consequences**

1. The range of abilities, knowledge, and skills, and the sheer number of "hands" that are available for acquiring and processing information increases with increasing group size.
2. The larger group provides a greater opportunity to meet interesting and attractive others with whom interaction may be rewarding.

##### **(ii) Negative consequences**

###### **1. Decreased participation**

The larger the group the less opportunity each person has to participate in discussion. Furthermore, group members often feel greater threat and greater inhibition of impulses to participate in larger groups than in small groups (Gibb, 1951). As a consequence there is a decrease in the overall amount of participation as the size of the group increases (Indik, 1965). Differences in relative participation by group members also increases with increasing group size. Some researchers (Bales et al., 1951; Hare, 1952) report that group members have fewer chances to speak in larger groups. As the size of the group increases, larger and larger proportions of group members participate less than their "fair share": a few members tend to dominate the discussion, with others participating relatively less as size increases. The lack of time for each member to participate, the increasing domination of the group's activities by

one or a few members, and the increased difficulty of maintaining interpersonal relationships in larger groups obviously contribute to negative feelings about the group.

## 2. Conformity to normative group pressures

On the one hand, in general, the larger the group the greater the difficulty in achieving consensus. Hare (1976) found that in larger groups, as compared with smaller groups, there was less consensus about discussion issues and that group members changed less toward consensus. Consensus becomes harder to achieve, and affectional ties and satisfaction with the group decline (Hoffman, 1979; Thomas & Fink, 1963). On the other hand, there are pressures toward uniformity in groups that tend to produce more consensus and conformity to group standards in larger groups (Janis, 1989).

## 3. Potential for conflict

The potential number of interpersonal relationships between group members increases rapidly with size; subgroups are more likely to form in larger groups and the potential for conflict is correspondingly greater.

Therefore, increasing the size of the group introduces opposing forces with respect to group performance and productivity. On the one hand, the added resources that are available in larger groups (abilities, knowledge, range of opinions, etc.) contribute to effective group performance; on the other hand, the increased organisational problems and inhibitions of some members' impulses to contribute tend to decrease the effectiveness of the group. The effect of size on group performance is the resultant of these opposing forces; whether the performance will become more or less effective as size increases will depend upon the degree to which added resources can be utilised and the degree to which group processes exert negative influence on group output.

Some group dynamics researchers generally maintain that small groups are more effective and more satisfying to belong to (Shaw, 1981). They are more likely to actively attempt to resolve opinion differences, whereas larger groups tend to use humour as a tension-reducing mechanism (Bales & Borgatta, 1955; Hare et al., 1967). They, then, suggest that most effective group size is three (Mills, 1953; 1956) or five (Hackman & Vidmar, 1970; Hare, 1981; Shaw, 1981; Slater, 1958). Once size rises above this, they argue that effectiveness decrease, as there is less opportunity for group members to participate; a few participants dominating the process can largely preclude other's participation.

However, Berelson and Steiner (1964) suggest that 12 members in size is probably the upper limit to enable each member to react and interact with every other member. Hellriegel et al. (1986) list some of the possible effects of size on groups (see table VI-15). It shows nine dimensions of groups in three categories (leadership, members, and group process). The likely effects of group size for each of these dimensions vary from low to moderate to high. It shows that, for example, members of groups of 8 or more interact differently than they do in groups of 2 to 7 members.

**Table VI-15: Some possible effects of size on groups (from Hellriegel et al. 1986, p.241)**

Category/Dimension	Group Size		
	2-7	8-12	13-16
<b>I. Leadership</b>			
1. Demands on leader	L	M	H
2. Differences between leaders and members	L	L to M	M to H
3. Direction by leader	L	L to M	M to H
<b>II. Members</b>			
4. Tolerance of direction from leader	L to H	M to H	H
5. Domination of group interaction by a few members	L	M to H	H
6. Inhibition in participation by ordinary members	L	M	H
<b>III. Group Process</b>			
7. Formalisation of rules and procedures	L	L to M	M to H
8. Time required for reaching judgement decisions	L to M	M	M to H
9. Tendency for subgroups to form within group	L	M to H	H

\* L: low, M: moderate, H: high

Phillips and Phillips (1990) also regard the group size as a major influence on the balance between individuality and the group life. They divide a group into three levels according to size: intimate, small, and large group. Two to 6 people constitute a "intimate group", in which maximum individuality is preserved. "Small group" of 7 to 15 is small enough to be able to work to consensus on the issues, but large enough to represent all major perspectives. All participants have ample opportunities to express their views, and differences of opinion can be used by the group in constructive ways to generate new perspectives. Here, individuality and group processes are just the right balance for creative work by the group to be accomplished in a short time. Eye-to-eye contact can be maintained, and it is difficult for any participant to become anonymous. When the number of participants exceeds 15, a "large group", group processes dominate, and individuality is submerged.

As we have reviewed here, researchers are quite different from each other in classifying groups according to size. DeSanctis and Gallupe (1987) even suggest that classifying groups according to size is rather arbitrary; perhaps it is best to think of groups as being relatively small or relatively large.

In the meantime, Dennis et al. (1988) point to three forces acting to increase the size of group meetings as follows:

- (1) The issue to be addressed by the group is one that could benefit from the increased domain knowledge and skills provided by the members in the group. So, it increases the desired size of the group.
- (2) Ackoff (1981) argues that it is important for those charged with executing a plan or implementing a decision to understand why the plan or decision was made. The best way to do this is to include as many of these people as possible in the group, again increasing the desired group size.
- (3) There are political reasons for increasing the size of the group. By including additional participants in the decision-making group, their support is more likely to be gained for the decision- or at least the blame is spread! Likewise, some organisational participants may insist on being present in meetings to ensure that their constituencies are represented.

All of the researchers above, however, add that all the effects of size on group process may be modified by other variables, such as the personal characteristics of group members, group task, the structure of the group, time constraints, and other factors such as the presence of a facilitator. In particular, Maier (1967) argues that group performance can only be enhanced if the group's leader serves as an integrator, focusing on process rather than group products.

## **(2) Multi workstation-based GDSS research**

Much previous multi workstation-based GDSS research has focused on its use by small groups of three to five students in laboratory experiments. This is because of the results of previous group dynamics studies which suggest that small groups are more effective. These laboratory experiments have produced rather mixed results, as contrasted with its success in field studies. Some of multi workstation-based GDSS researchers explain this mixed results due to smaller group size and less complex tasks than those typically found in field settings (groups of 7 to 10 or larger with much more complex tasks).

Huber (1982) points out that the use of a GDSS where it is less appropriate may cause frustration with the decision-making process, if the technology overwhelms the task or becomes more trouble than it's worth. A number of group dynamics researchers (Hackman, 1968; Hirokawa & Pace, 1983) have found that frustration with the group process leads to dissatisfaction in group decision-making. Therefore, if the group sees

the GDSS as an impediment to their group activities, they may become frustrated and dissatisfied with the group decision process. Proponents of a multi workstation GDSS have pointed out that use of a GDSS technology has some overhead costs (Dennis et al., 1988; Gallupe et al., 1988). Dennis et al. (1988) state that the overhead costs (or "process losses") introduced by the specific (in fact, multi workstation-based) GDSS may simply have been higher than the marginal benefits provided to small groups addressing less complex tasks. In fact, Arizona researchers have observed that small groups are more frustrated by the system constraints of the various software tools. Specifically, Nunamaker et al. (1988) report that for groups up to 6-8 there is a significant technological intrusion in the system. They conclude that for small groups, computer-aided support is not more effective or efficient than an unstructured face-to-face meeting. Other multi workstation-based GDSS researchers also expect that the impact of a (multi workstation-based) GDSS may be significant only in larger size groups (DeSanctis & Gallupe, 1987; Gallupe et al., 1988; Jarvenpaa et al., 1988). So, some of them (e.g., Dennis et al., 1988) argue that results from groups of 5 or fewer members cannot be extended to larger groups.

Recently, multi workstation-based GDSS researchers have continuously observed that efficiency and effectiveness consideration of automated support become increasingly apparent as group size increases (Nunamaker et al., 1989; Vogel et al., 1987; Vogel & Nunamaker, 1990). They report that groups of size 8 or more tend to benefit more than groups of size 3 or 4.

As group size increases above four, automated support enhanced group efficiency by facilitating input from all group members in a relatively simultaneous fashion; i.e., human parallel processing. Members need not "wait their turn" to contribute to the question or problem before the group. For larger groups, effectiveness of automated support becomes particularly apparent in eliciting and organising large numbers of issues associated with a complex question. Larger groups appreciate the structuring inherent within the system to keep the group from becoming "bogged down." Without structured automated support, larger groups tend to "falter" and fail to work efficiently or effectively (Nunamaker et al., 1988; 1989; Vogel et al., 1987; Vogel & Nunamaker, 1990).

As we saw in previous chapter, there are fundamental differences between the multi workstation-based GDSS and the single workstation-based GDSS. Decision Conferencing is a single workstation-based GDSS. In this section, therefore, we

examine whether the findings from multi workstation-based GDSS research can be applied to the cases of the single workstation-based GDSS:

(1) For small groups, the support of a multi workstation-based system is found not to be more effective or efficient than an unstructured face-to-face meeting. Unlike the environments of multi workstation-based GDSS, participants in DCs do not directly interact with the computer by themselves. So, we can expect that compared to the users of multi workstation-based GDSS, technical intrusion problem should be of little importance to the users of single workstation-based GDSS. In other words, overhead costs of single workstation-based GDSS would be much less than those of multi workstation-based GDSS.

If so, we can hypothesize that even for small groups, the support of a single workstation-based system (here, DC) could be more effective or efficient than an unstructured face-to-face meeting. This hypothesis is tested.

(2) The researchers of multi workstation GDSS have continually claimed that efficiency and effectiveness consideration of a multi workstation GDSS become increasingly apparent as group size increases (Nunamaker et al. 1989; Vogel et al. 1987; Vogel & Nunamaker 1990). Especially, Arizona researchers (Nunamaker et al. 1989) claim that meeting productivity and the effectiveness and efficiency of the equal participation can be remarkably enhanced due to parallel processing approach of electronic communication channel. Also, they assert that resorting to a single workstation for large groups simply does not work.

If their assertions are correct, the support of a single workstation-based system (here, DCs) should become less effective or especially less efficient, as groups become larger. Their assertions are tested here.

## 6.5.2. Findings

### (1) Facilitator: Peterson

Table VI-16 below presents the results of 10 analyses of variance to test the differences in perceived effectiveness of DCs according to the variety of group size, under Peterson's facilitation.

The results of statistical analysis show that large groups (size: 26, 30) perceived the effectiveness of DCs in aiding group collaborative work discernibly higher than did medium groups (size: 9, 11, 13) with regard to Legitimacy of decision (=decision acceptance, Q4), Efficiency of decision (Q5), and Supportability of decision (=implementation, Q8). But, mean values in table VI-16 show us that the larger groups' scores are higher than those of medium sized groups for all of the 10 evaluation criteria. It would mean that Peterson's facilitation method was perceived more effective in aiding large groups rather than medium ones.

**Table VI-16: Results of two sample T-test for measures of perceived DC effectiveness differences according to group size (individual score as a unit of analysis. WH+TV. conducted by Peterson. American managers. n = 57)**

Criteria for measures of DC effectiveness	Size: 9,11,13 (n = 26)	Size: 26,30 (n = 31)	P - value
Q1. Participatory Process	5.50	5.90	0.23
Q2. Data-based Process	5.54	5.84	0.37
Q3. Adaptable Process	5.92	5.94	0.97
Q4. Legitimacy of Decision	4.77	5.94	0.0003**
Q5. Efficiency of Decision	5.50	6.19	0.014**
Q6. Goal-centred Process	5.85	5.94	0.74
Q7. Accountability of Decision	5.27	5.58	0.43
Q8. Supportability of Decision	4.58	5.35	0.044**
Q9. Attitudes: Challenge and Accomplishment	5.46	5.65	0.55
Q10. Attitudes: Enhancement of Problem-solving Ability	6.08	6.26	0.37

\*\* : statistically significant to reject null hypothesis with 95% credibility

As we saw before, Ackoff (1981) argues that it is important for those charged with implementing a decision to understand why the decision was made. The best way to do this is to include as many of these people as possible in the group (Dennis et al., 1988). Larger group means the inclusion of more stake holders in their problem-



solving process. Thus, if the meeting were properly conducted, it may be natural that Legitimacy of decision (=decision acceptance Q4) and Supportability of decision (=implementation Q8) become enhanced with larger group size.

Of greater interest is the finding that large groups rated the process of DCs to be more efficient than did medium groups. Proponents of multi workstation GDSSs (DeSanctis & Gallupe, 1987; Nunamaker et al., 1989; Vogel et al., 1987) state that verbal communication becomes less effective with a large group. Either the opportunity for equal participation of all group members is removed, or, if equal participation occurs, participants have far less time in which to communicate their ideas and opinions than they would in an equivalent small group meetings. So, they argue that the primary goals of a GDSS are to make meetings more productive through improving group communication activities in terms of encouraging equality of participation and increasing the efficiency of that participation. Then, they suggest that these goals can be achieved by providing an electronic communication channel to each group members, which enables participants to get equal participation, anonymous messaging function, impersonalised process, voting, and efficiency of that participation by facilitating input from all group members in a relatively simultaneous fashion (parallel processing) (Dennis et al., 1988; Vogel & Nunamaker, 1990). Arizona researchers (Nunamaker et al., 1989) claim that meeting productivity and the efficiency of the equal participation can be remarkably enhanced due to parallel processing approach of electronic communication channel. They, then, conclude that resorting to single workstation for large groups simply does not work. If their claims are correct, the perceived effectiveness of DCs should become lower with regard to Participatory process (Q1) and Efficiency of decision (Q5) as group size becomes larger. Reversely, the results in table VI-16 show that larger groups appreciated the effectiveness of DCs with regard to these criteria more than did medium groups. The results may suggest us that, if properly facilitated, a single workstation-based GDSS (here, a DC) can be used successfully to aid the collaborative work of larger groups. If so, the heavy investments in multi workstation GDSS should be questioned.

Like the results in previous sections, the high correlation between the large groups' and medium groups' rankings of the scores on the 10 criteria shows that the perceived effectiveness of DCs across the 10 evaluation criteria represents consistent patterns irrespective of the differences in group size (see table VI-17 below).

**Table VI-17: Correlation of the ranks of the scores on the 10 evaluation criteria  
(under Peterson's facilitation. WH+TV. American managers. two-tailed test)**

Correlation of Two Group Size	$r_s$
Medium size of 9,11,13 (n=26) and Large size of 26,30 (n=31)	0.658**

$r_s$ : Spearman's rank correlation coefficient

\*\* : reject the null hypothesis that there is no association between the rank pairs with 95% significance

## (2) Facilitator: Hall

Table VI-18 below presents the results of 12 analyses of variance to test the differences in perceived effectiveness of DCs according to the variety of group size, under Hall's facilitation.

Contrary to the results of Peterson's, the results of statistical analysis (p-values) show that under Hall's facilitation, medium groups (size: 9, 10, 11) perceived the effectiveness of DCs discernibly higher than did large groups (size: 16, 19) with regard to 11 out of 12 evaluation criteria. Of course, mean values in table VI-18 show that the medium groups' scores are higher than those of large groups for all of the 12 evaluation criteria.

**Table VI-18: Results of two sample T-test for measures of perceived DC effectiveness differences according to group size (individual score as a unit of analysis. ICL. conducted by Hall. British managers. n = 24)**

Criteria for measures of DC effectiveness	Size: 9,10,11 (n=13)	Size: 16,19 (n=11)	P - value
Q1. Participatory Process	5.0	4.46	0.11*
Q2. Data-based Process	5.54	4.64	0.0034**
Q3. Adaptable Process	5.62	4.82	0.055*
Q4. Legitimacy of Decision	5.54	4.55	0.015**
Q5. Efficiency of Decision	5.77	4.64	0.011**
Q6. Goal-centred Process	5.69	4.36	0.0022**
Q7. Accountability of Decision	4.77	3.55	0.0031**
Q8. Supportability of Decision	4.54	3.91	0.049**
Q9. Attitudes: Challenge and Accomplishment	4.69	4.27	0.35
Q10. Attitudes: Enhancement of Problem-solving Ability	6.0	5.27	0.038**
Q11. Decision Quality: # of alternatives generated	5.77	4.91	0.083*
Q12. Decision Quality: # of criteria considered	6.0	5.09	0.0048**

\* : statistically significant to reject null hypothesis with 90% credibility

\*\* : statistically significant to reject null hypothesis with 95% credibility

Figure VI-15 below provides a visual representation of the results in table IV-24. It shows the clear differences between two different sized groups in their perceived effectiveness of DCs for all of the 12 evaluation criteria. However, it also reveals that the perceived effectiveness of DCs has consistent patterns throughout the 12 criteria, irrespective of the differences in group size. Spearman's rank correlation coefficient of the large sized groups' and medium ones' rankings of the scores on the 12 criteria supports the finding with statistical significance (see table VI-19 below).

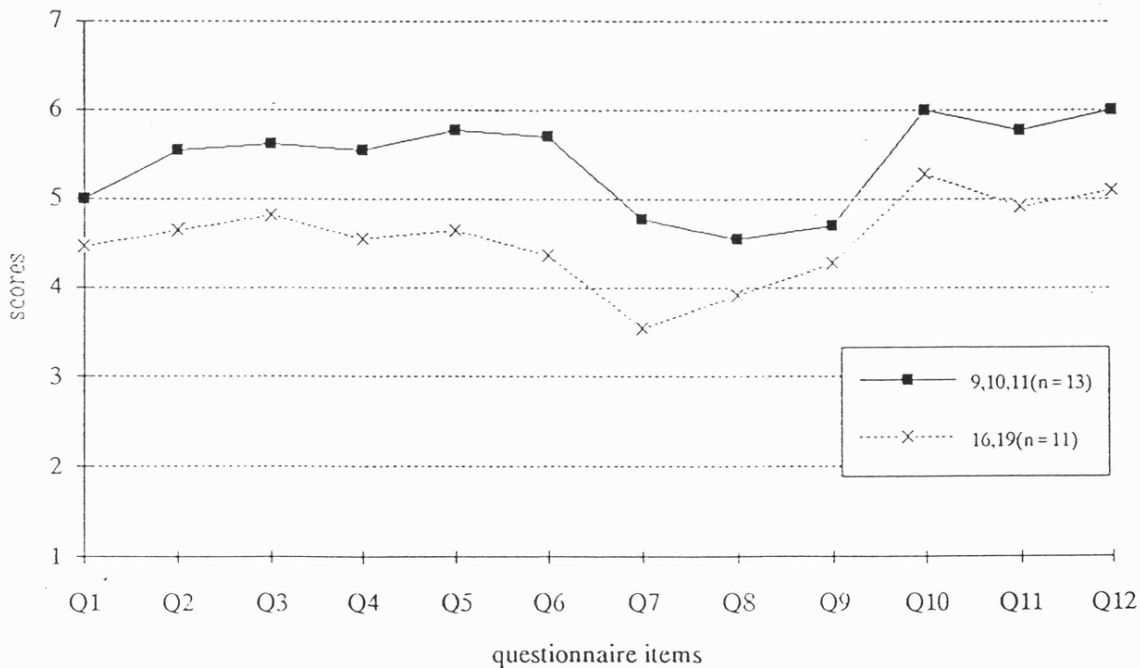
**Table VI-19: Correlation of the ranks of the scores on the 12 evaluation criteria (under Hall's facilitation. ICL only. British managers. two-tailed test)**

Correlation of Two Group Size	$r_s$
Medium size of 9,10,11 (n=13) and Large size of 16,19 (n=11)	0.873****

$r_s$ : Spearman's rank correlation coefficient

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

**Figure VI-15: Comparison of DC effectiveness between large groups (size: 16,19) and medium ones (size: 9, 10, 11), both were facilitated by Hall (individual score as a unit of analysis. ICL. British managers. n=24)**



Overall, unlike Peterson's, Hall's facilitation method was perceived convincingly more effective in aiding medium size groups (9, 10, 11) rather than large ones (16, 19).

### (3) Facilitator: Phillips

Table VI-20 below presents the results of 12 analyses of variance to test the differences in the perceived effectiveness of DCs according to the variety of group size, under Phillips' facilitation.

In general, table VI-20 shows that the perceived effectiveness of DCs of small groups (size: 4, 6, 8) was higher than that of medium (size: 9, 11) or larger(size: 15, 18) ones. But, large groups (size: 15, 18) perceived the effectiveness of DCs in aiding their decisional activity higher than did medium ones (size: 9, 11).

**Table VI-20: Results of two sample T-test for measures of perceived DC effectiveness differences according to group size (individual score as a unit of analysis. various co.+ICL. conducted by Phillips. British managers. n=60)**

Criteria for measures of DC effectiveness	Size: 4,6,8 (n=19)	Size: 9,11 (n=27)	Size:15,18 (n=14)	P - value 4,6,8 vs 9,11	P - value 4,6,8 vs 15,18	P - value 9,11 vs. 15,18
Q1. Participatory Process	5.37	5.0	5.71	0.32	0.42	0.051*
Q2. Data-based Process	5.26	4.89	4.93	0.33	0.47	0.93
Q3. Adaptable Process	5.95	5.59	5.57	0.24	0.22	0.94
Q4. Legitimacy of Decision	5.37	4.58	5.21	0.029**	0.77	0.21
Q5. Efficiency of Decision	5.37	5.07	5.79	0.45	0.29	0.023**
Q6. Goal-centred Process	5.68	5.27	5.64	0.26	0.90	0.26
Q7. Accountability of Decision	5.11	4.19	4.79	0.014**	0.39	0.11*
Q8. Supportability of Decision	5.05	4.27	4.21	0.017**	0.024*	0.85
Q9. Attitudes: Challenge and Accomplishment	5.26	5.11	5.36	0.64	0.81	0.52
Q10. Attitudes: Enhancement of Problem-solving Ability	5.89	6.0	5.79	0.72	0.76	0.49
Q11. Decision Quality: # of alternatives generated	5.90	5.82	5.71	0.72	0.57	0.74
Q12. Decision Quality: # of criteria considered	5.79	5.85	5.86	0.83	0.83	0.98

\* : statistically significant to reject null hypothesis with 90% credibility

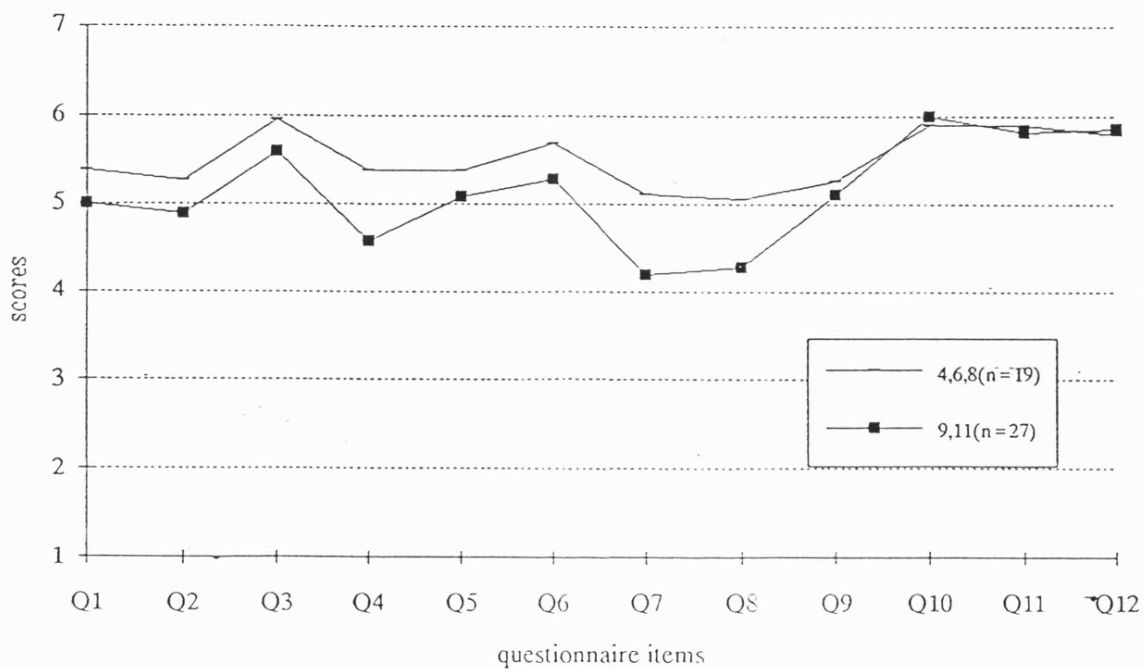
\*\* : statistically significant to reject null hypothesis with 95% credibility

#### (i) Small (size: 4, 6, 8) vs. medium (size: 9, 11) groups

Figure VI-16 below presents the results in table VI-20 graphically. It depicts the clear difference between small groups and medium size ones in their perceived effectiveness of DCs for the 12 evaluation criteria. Considering the results of statistical analysis (p-values) in table VI-20 and raw data (fig. VI-16) together, we may summarise that small groups (size: 4, 6, 8) perceived the effectiveness of DCs in aiding their decisional activity higher than did medium groups (size: 9, 11) with regard

to 9 out of 12 evaluation criteria, especially in Legitimacy of decision (=decision acceptance, Q4), Accountability of decision (Q7), and Supportability of decision (=implementation, Q8). But, there were little differences in the perceived effectiveness between small groups and medium ones with regard to Decision quality (the number of alternatives and criteria considered Q11, Q12), and Attitudes (challenge and accomplishment and enhancement of problem-solving ability Q9, Q10).

**Figure VI-16: Comparison of DC effectiveness between small groups (size: 4, 6, 8) and medium ones (size: 9, 11), both were facilitated by Phillips (individual score as a unit of analysis. various co.+ICL. British managers. n=46)**

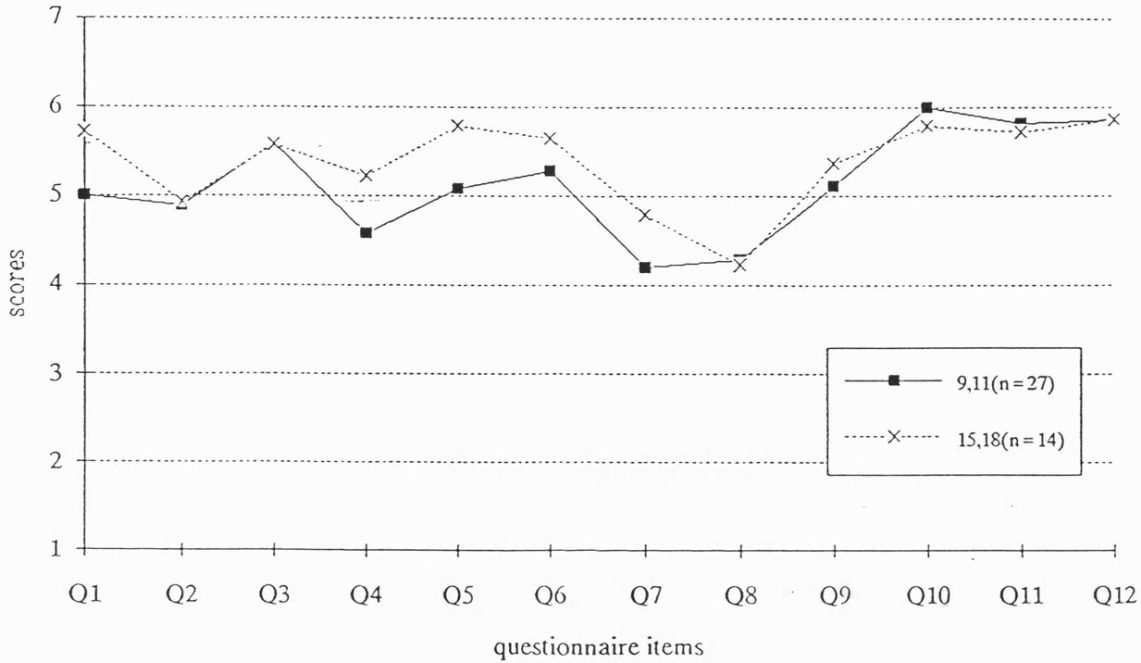


**(ii) Medium (size: 9, 11) vs. large (size: 15, 18) groups**

Figure VI-17 below presents the difference between medium groups and large ones in their perceived effectiveness of DCs for the 12 evaluation criteria. The results of statistical analysis in table VI-20 and raw data (fig. VI-17) together show that large groups (size: 15, 18) perceived the effectiveness of DCs higher than did medium groups (size: 9, 11) with regard to 5 out of 12 evaluation criteria, especially in Participatory process (Q1), Efficiency of decision (Q5), and Accountability of decision (Q7). But, there was little difference in the perceived effectiveness of DCs between two groups with regard to Data-based process (Q2), Adaptable process (Q3),

Supportability of decision (=implementation Q8), Attitudes (challenge and accomplishment, and enhancement of problem-solving ability Q9, Q10), and Decision quality (the number of alternatives and criteria generated Q11, Q12).

**Figure VI-17: Comparison of DC effectiveness between medium groups (size: 9, 11) and large ones (size: 15, 18), both were facilitated by Phillips (individual score as a unit of analysis. various co.+ICL. British managers. n = 41)**



Here, like the results in Peterson's, we have found that, under Phillips' facilitation, large groups (size: 15, 18) rated the effectiveness of DCs discernibly higher than did medium groups (size: 9, 11) with regard to Efficiency of decision (Q5), and even Participatory process (Q1). This finding supports the conjecture of previous section: if properly facilitated, a single-workstation based GDSS (here, a DC) can be used successfully to aid the collaborative work of large groups.

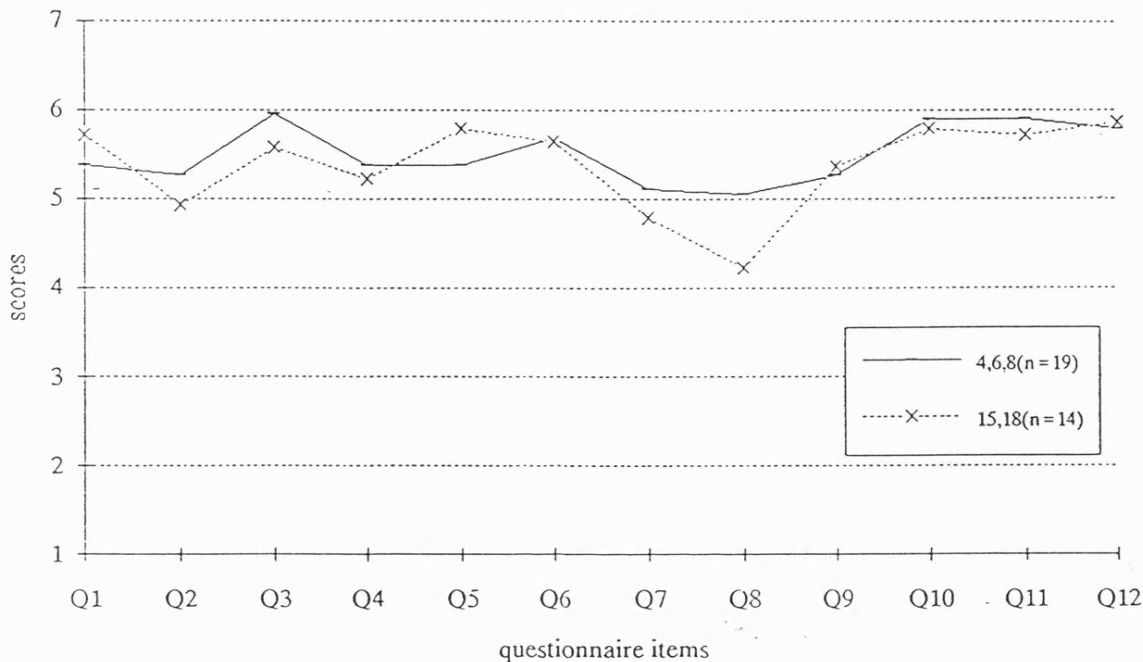
**(iii) Small (size: 4, 6, 8) vs. large (size: 15, 18) groups**

Figure VI-18 below presents the results in table VI-20 graphically. It also shows the differences between small groups and large ones in their perceived effectiveness of DCs for the 12 evaluation criteria, under Phillips' facilitation.

P-values in table VI-20 and raw data (fig. VI-18) together reveal that small groups (size: 4, 6, 8) perceived the effectiveness of DCs in aiding their work higher than did large groups (size: 15, 18) with regard to 4 out of 12 evaluation criteria: Adaptable

process (Q3), Efficiency of decision (Q5), Accountability of decision (Q7), and especially Supportability of decision (=implementation, Q8).

**Figure VI-18: Comparison of DC effectiveness between small groups (size: 4, 6, 8) and large ones (size: 15, 18), both were facilitated by Phillips (individual score as a unit of analysis. various co.+ICL. British managers. n=33)**



But, there were little differences in the perceived effectiveness of DCs between small groups and large ones with regard to 6 out of 12 criteria: Legitimacy of decision (Q4), Goal-centred process (Q6), Attitudes in terms of challenge and accomplishment, and enhancement of problem-solving ability (Q 9, Q10), and Decision quality in terms of the number of alternatives and criteria considered (Q11, Q12).

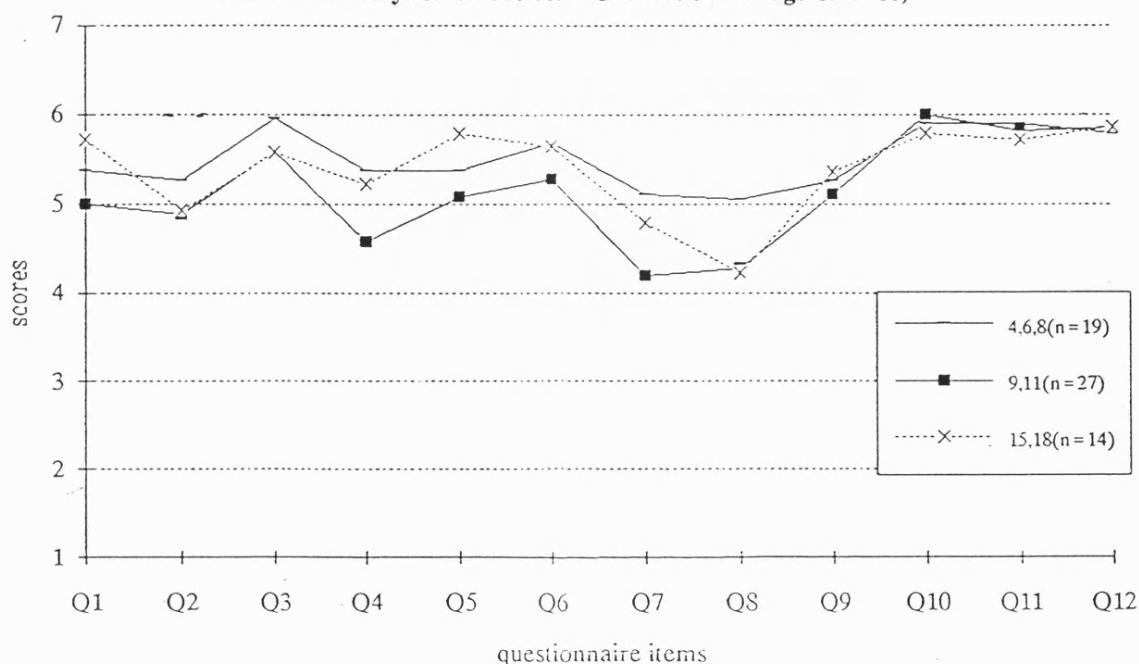
Again, like the results of comparison between large groups (size: 15, 18) and medium ones (size: 9, 11) in previous section, under Phillips' facilitation, large groups rated the effectiveness of DCs in aiding their decision-making activity discernibly higher than did small groups (size: 4, 6, 8) with regard to Efficiency of decision (Q5), and Participatory process (Q1).

**(iv) Small (4, 6, 8) vs. medium (9, 11) vs. large (15, 18) groups**

Figure VI-19 below integrates previous three parts altogether. It depicts the differences in the perceived effectiveness of DCs according to the variety of group size, under Phillips' facilitation.

It shows that there were little differences in the perceived effectiveness of DCs between different group size with regard to Attitudes in terms of challenge and accomplishment, and enhancement of problem-solving ability (Q 9, Q10), and Decision quality in terms of the number of alternatives and criteria considered (Q11, Q12). This compliments my previous finding (Chun, 1988a), that group size was found to have no association with the number of alternatives and criteria generated.

**Figure VI-19: Comparison of DC effectiveness between small (size: 4, 6, 8), medium (9,11), and large groups (size: 15, 18), facilitated by Phillips (individual score as a unit of analysis. various co.+ICL. British managers. n=60)**



It is interesting to note that under Phillips' facilitation, large groups, compared to medium and small ones, perceived the effectiveness of DCs higher with regard to Participatory process (Q1) and Efficiency of decision (Q5). This finding shows that enhanced efficiency and participation in large groups can also be achieved by single workstation-based GDSS, not necessarily only by electronic communication channel in multi workstation-based GDSS.

Figure VI-19 above also depicts the consistent tendency of the perceived effectiveness of DCs for the 12 evaluation criteria, irrespective of the differences in group size. Spearman's rank correlation coefficient of the two different size groups' rankings of the scores on the 12 criteria supports this finding with statistical significance (see table VI-21 below).



**Table VI-21: Correlation of the ranks of the scores on the 12 evaluation criteria  
(under Phillips' facilitation. various co.+ ICL. British managers. two-tailed test)**

Correlation of Two Group Size	$r_s$
Small size of 4,6,8 (n=19) and Medium size of 9,11 (n=27)	0.857****
Small size of 4,6,8 (n=19) and Large size of 15,18 (n=14)	0.715***
Medium size of 9,11 (n=27) and Large size of 15,18 (n=14)	0.804****

$r_s$ : Spearman's rank correlation coefficient

\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 98% significance

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

In the previous section, under Peterson's facilitation, we saw that compared to medium groups (size: 9, 11, 13), large groups (size: 26, 30) perceived the effectiveness of DCs much higher with regard to the criterion of Supportability of decision (=implementation Q8). We, then, assumed that because larger groups usually include more stake holders in their problem-solving process, the meeting outcome could be supported by more people, thus it would have more chance to be implemented. However, as far as Supportability of decision (=implementation Q8) is concerned, fig. VI-19 above shows that, under Phillips' facilitation, small groups rated clearly higher than did medium and large groups.

Now, we have contradictory results here. This contradictory findings might indicate that the previous argument (Dennis et al., 1988) about the positive relationship between group size and implementation of decision is premature. Or, they might also indicate that group size has little effect on the implementation of the decision. Then, what influences the implementation of the decision?

In the meantime, we need to note that independent of the differences in the variables investigated so far (i.e., variety of facilitators, organisation differences, nationality of the subjects, respondents' strata, and group size), a DC was perceived relatively less effective with regard to Accountability of decision (Q7) and Supportability of decision (Q8), compared to other evaluation criteria. Why? Phillips (1991) provides clear answers to this question as follows:

In an accountability hierarchy, we know that individuals are held accountable for their work and that of their subordinates. Organisations do not hold groups accountable; at least, I have never encountered an organisation that seriously entertained the idea of firing an entire group of people because they had collectively failed. Using the decision theorist's definition of a decision (an irrevocable commitment of a resource), only individuals take decisions, for only individuals can be held accountable for the consequences of using the resource. *Groups do not take decisions.* Even if a decision is

delegated to a group, it is the manager who finally takes it, for in addition to having the power to veto it, only the manager is authorised to commit the resource. To establish a decision making process that requires a manager to arrive at a decision only when he obtains collective agreement to it from his subordinates contradicts his accountability, undermines his authority and cripples his leadership capacity (Phillips, 1991).

The decision making process in DCs generally involves a manager, his peers, and subordinates together, and encourages equal communication among them to obtain collective agreement to a decision. As Phillips points out, this process may contradict the decision taker's accountability, and undermine his authority. Low scores in Accountability of decision (Q7) support empirically this view. Therefore, implementation of decisions can be hardly improved. A similar view was raised by King (1985): ".....the computer amplifies analytic abilities, but does little to support the vision and leadership so critical to corporate success....(p.xi)."

Phillips' articulation above (and, the present empirical results support his view) raises a question to the current trend in GDSS research, especially in multi workstation-based GDSS environment which emphasises more "equal" participation of the members through electronic communication channel. The electronic communication media inevitably tends to ignore participants' differences in terms of their roles, strata, power, and etc. Therefore, decision taker's authority and leadership can be likely more damaged in multi workstation-based GDSS environment, compared to the single workstation GDSS. Then, the implementation of decisions in multi workstation-based GDSS environment is likely not to follow.

GDSS research so far has concentrated its effect on decision quality, decision time, or user satisfaction. No research has been found to investigate its effect on the improvement of implementation of a decision. Future GDSS research should address this important issues more carefully. Because, even if a decision-making aids produces higher quality outcomes, this is useless if implementation does not follow.

In the meantime, the present pilot study supports Phillips' articulation (1991) above that decision making process that requires a manager to arrive at a decision only when he obtains collective agreement to it from his subordinates contradicts his accountability. Therefore, even a single workstation-based GDSS (here, DC) was perceived relatively less effective with regard to Accountability of decision (Q7), compared to other criteria. Therefore, implementation of decisions (=Supportability of decision Q8) was hardly improved.

### 6.5.3. Summary

(1) Peterson's facilitation was perceived more effective in aiding large groups (size 26, 30) rather than medium ones (9, 11, 13). The results of statistical analysis show that under Peterson's facilitation, large groups perceived the effectiveness of DCs discernibly higher than did medium groups with regard to Legitimacy of decision (=decision acceptance Q4), Efficiency of decision (Q5), and Supportability of decision (=implementation Q8).

(2) Hall's facilitation was perceived convincingly more effective in aiding medium size groups (9, 10, 11) rather than large ones (16, 19).

(3) Under Phillips' facilitation, the perceived effectiveness of DCs of small groups (size: 4, 6, 8) was higher than that of medium (size: 9, 11) or large (size: 15, 18) ones. But, large groups perceived the effectiveness of DCs higher than did medium ones. Like the results of Peterson's, large groups rated the DC in aiding their collaborative work discernibly higher than did medium or small groups with regard to Efficiency of decision (Q5) and even Participatory process (Q1).

(4) The findings of (1) and (3) together suggest that unlike the anticipation of proponents of multi workstation-based GDSS, the efficiency and participation of decision processes in large groups can also be enhanced by single workstation-based GDSSs, not necessarily by only an electronic communication channel in multi workstation-based GDSSs.

(5) The findings in this section show that there is an evident interaction effect between the facilitator's style and the size of the group. Peterson has told me that he prefers to facilitate large groups. Reflecting his preference, Peterson's facilitation was perceived more effective in aiding large groups (size 26, 30) rather than medium ones (9, 11, 13). Phillips has indicated his preference for facilitating medium groups of 7 to 15. However, under Phillips' facilitation, the perceived effectiveness of DCs of medium groups (size: 9, 11) was lower than that of small (size: 4, 6, 8) or large (size: 15, 18) ones. Small groups rated the effectiveness of DCs higher than did medium or larger ones.

(6) Multi workstation-based GDSS researchers (Vogel & Nunamaker, 1990) report that their system can be used successfully both by mature groups where the members are familiar with each other and by groups specially formed to address a specific

problem or question. In DCs, larger groups tended to be new ones having been assigned a particular task and smaller groups tended to be mature ones of which members having been familiar with each other. The present study shows that a single workstation-based GDSS (here, a DC) can also be used successfully by both types of group.

(7) Like the consistent results in previous sections, the perceived effectiveness of DCs for the 12 (in case of Peterson, 10) evaluation criteria again represented consistent patterns irrespective of the differences in group size; Spearman's rank correlation coefficient of the two groups of rankings of the scores on the 12 criteria obtained from the managers in different group size supports this finding with statistical significance (see table VI-17, -19, and -21 earlier).

(8) Ackoff (1981) asserts that it is important for those charged with implementing a decision to understand why the decision was made. The best way to do this is to include as many of these people as possible in the group (Dennis et al., 1988). Therefore, it is generally assumed that because larger groups usually include more stake holders in their problem-solving process, the meeting outcome could be supported by more people, thus it would have more chance to be implemented. The empirical results of this study indicate that this assumption about the positive relationship between group size and implementation of the decision may be premature.

Independent of numerous variables investigated so far, a DC was perceived relatively less effective with regard to Accountability of decision (Q7) and Supportability of decision (=implementation Q8), compared to other evaluation criteria. This supports the Phillips' articulation (1991) that the lateral process which is usually encouraged in GDSSs may contradict the decision taker's accountability. Therefore, implementation of a decision can be hardly improved.

Phillips' articulation above (and, the present empirical results support his view) raises a question to the current trend in multi workstation-based GDSS research which emphasises more "equal" participation of the members through an electronic communication channel. The electronic communication media inevitably tends to ignore participants' differences in terms of their roles, strata, power, and etc. Therefore, decision taker's authority and leadership can be likely more damaged in multi workstation-based GDSS environment, compared to the single workstation GDSS. If so, the implementation of decisions in multi workstation-based GDSS

environment is more likely to be deteriorated. GDSS research so far has concentrated its effect on decision quality, decision time, or user satisfaction. No research has been found to investigate its effect on the improvement of implementation of a decision. Future GDSS research should address this important issues more carefully.

## 6.6. Prior Experience with GDSSs

### 6.6.1. Previous research

In general, introducing a GDSS to a conventional group work is an alien element. Previous GDSS research shows that some learning periods through repeated use of a GDSS is required before achieving improved performance and satisfaction, if the system requires users to access the system by themselves, irrespective of whether it is a user-, chauffeur-, or facilitator-driven GDSS (Dickson et al., 1989).

For example, in their user-driven and user-access GDSS experiments, Watson et al. (1988) and Gallupe et al. (1988) explained their unexpected findings (lower decision quality and less satisfaction with the use of GDSSs compared to manual structured methods) as due to users' cognitive struggle to deal with problems of technical unfamiliarity in their initial use of a GDSS. Watson et al. (1988) indicated the newness of the technology as the main reason why GDSS groups reported less substantial discussion of the issues and a less understandable problem-solving process. They expected the problem of less satisfaction and lower decision quality with initial stage of system use may be lessened with the use of a facilitator or chauffeur, or sustained usage. But, Easton et al. (1989) and Chidambaram et al. (1990) showed that this problem can only be partly lessened even in a facilitator-driven GDSS, if the system still requires users' direct access to the system. In their facilitator-driven and user-access GDSS experiments (the Plexsys of the University of Arizona), Easton et al. (1989) report higher satisfaction, but no difference in decision quality with the initial use of the system, compared to manual structured approach, and Chidambaram et al. (1990) report that, in the early stage of system use, GDSS groups' performance and satisfaction were worse than those of manual structured ones in terms of the ability to manage conflict and the degree of group cohesiveness. Chidambaram et al. (1990) conclude that comfort with a GDSS is critical to a group's successful adoption of its use, so GDSS groups need time to accommodate to the technology effectively.

Two longitudinal GDSS studies (Chidambaram et al., 1990; Van Schaik & Sol, 1990) show that group behaviour changed over time for GDSS use (see table VI-22 below). These longitudinal studies show that in user-access GDSS environments, learning through repeated use of the GDSS may be required before improved performance occurs. However, this required learning period through repeated use of the GDSS may cause problems with the introduction of a GDSS to real world managers, especially higher level ones. If they see no benefit, or even feel worse with their initial use of a GDSS, compared to a conventional meeting, they will not be willing to use

the system any more: they do not have time to play. As we saw before, user attitudes have been recognised as critical to acceptance and adoption of the technology particularly in organisational settings.

**Table VI-22: Summary of two longitudinal user-access type GDSS researches**

Chidambaram et al. (1990) Facilitator-driven and user-access GDSS (Plexsys of Arizona University)				
Session	1st	2nd	3rd	4th
The ability to manage conflict	GDSS < MS*	GDSS < MS	GDSS = MS	GDSS > MS
The degree of cohesiveness	GDSS < MS	GDSS < MS	GDSS > MS	GDSS > MS
Van Schaik and Sol (1990) User-driven and user-access GDSS				
Session	1st-5th		6th-7th	
Decision quality	GDSS < no GDSS		GDSS > no GDSS	

\* MS: manually structured method

Unlike the user-access type GDSS, a DC adopts the analyst (or recordist)-access mode: participants do not need to access the system by themselves. Therefore, it can be anticipated that problems associated with the initial use of a user-access type GDSS may be relatively lessened in a DC. Here, the perceived effectiveness of DCs is measured and compared as a function of the number of DCs a user had attended.

## 6.6.2. Findings

### (1) Facilitator: Peterson

Table VI-23 below presents the results of 10 analyses of variance to test the differences in the perceived effectiveness of DCs according to the variety of respondents' prior experiences with DCs in terms of the number of DCs they had attended, under Peterson's facilitation.

The results of statistical analysis (p-values) show that under Peterson's facilitation, the perceived effectiveness of DCs was independent of the number of DCs a participant had attended, for all of the 10 evaluation criteria (see table VI-23). It would mean that, unlike the case in user-access type GDSS, participants in DCs did not suffer from the problems of technical unfamiliarity with the initial use of the system.

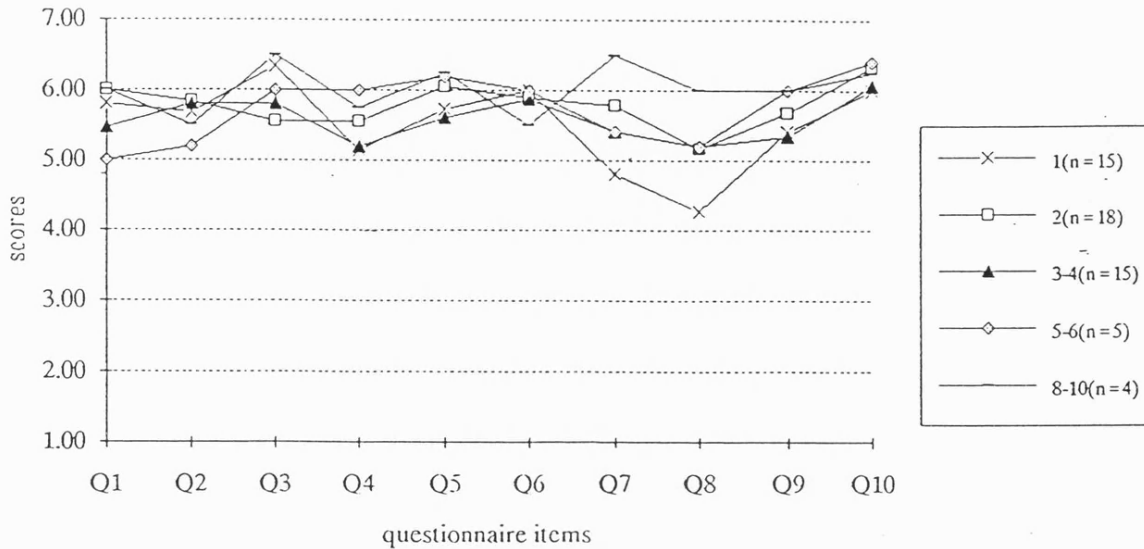
**Table VI-23: Results of ANOVA for measures of the perceived DC effectiveness differences according to the number of DCs a participant had attended (individual score as a unit of analysis. WH+TV. Peterson. American managers. n = 57)**

Criteria for measures of DC effectiveness	1 (n = 15)	2 (n = 18)	3-4 (n = 15)	5-6 (n = 5)	8-10 (n = 4)	P - value
Q1. Participatory Process	5.80	6.0	5.47	5.0	6.0	0.512
Q2. Data-based Process	5.67	5.83	5.8	5.2	5.5	0.876
Q3. Adaptable Process	6.33	5.56	5.8	6.0	6.5	0.295
Q4. Legitimacy of Decision (= decision acceptance)	5.13	5.56	5.2	6.0	5.75	0.605
Q5. Efficiency of Decision	5.73	6.06	5.6	6.2	6.25	0.635
Q6. Goal-centred Process	6.0	5.89	5.87	6.0	5.5	0.935
Q7. Accountability of Decision	4.8	5.78	5.4	5.4	6.5	0.196
Q8. Supportability of Decision (= implementation)	4.27	5.17	5.2	5.2	6.0	0.158
Q9. Attitudes: Challenge and Accomplishment	5.4	5.67	5.33	6.0	6.0	0.687
Q10. Attitudes: Enhancement of Problem-solving Ability	6.0	6.33	6.07	6.4	6.25	0.683

Figure VI-20 below presents graphically the values in table VI-23 above, which are the mean scores of the perceived effectiveness of DCs under Peterson's facilitation according to the number of DCs a respondent had attended. Like the results of statistical analysis in table VI-23, it generally shows the inconsistent relationships between the perceived effectiveness of DCs across the 10 evaluation criteria and the number of DCs a respondent had attended.



**Figure VI-20: Comparison of perceived DC effectiveness according to the number of DCs a participant had attended (individual score as a unit of analysis. Peterson. WH+TV co., American managers. n=57)**



We have repeatedly observed that the perceived effectiveness of DCs across the evaluation criteria represents consistent patterns irrespective of the variables investigated so far. Table VI-24 below shows the correlation between the two groups of rankings of the scores on the 10 criteria, based on the differences in the number of DCs a participant had attended.

**Table VI-24: Correlation of the ranks of the scores on the 10 evaluation criteria (under Peterson's facilitation. WH+TV. American managers. two-tailed test)**

Correlation of Two # of Attendance	$r_s$
# of Attendance of 1 (n=15) and # of Attendance of 2 (n=18)	0.506
# of Attendance of 1 (n=15) and # of Attendance of 3-4 (n=15)	0.838****
# of Attendance of 1 (n=15) and # of Attendance of 5-6 (n=5)	0.406
# of Attendance of 1 (n=15) and # of Attendance of 8-10 (n=4)	0.118
# of Attendance of 2 (n=18) and # of Attendance of 3-4 (n=15)	0.679**
# of Attendance of 2 (n=18) and # of Attendance of 5-6 (n=5)	0.352
# of Attendance of 2 (n=18) and # of Attendance of 8-10 (n=4)	0.040
# of Attendance of 3-4 (n=15) and # of Attendance of 5-6 (n=5)	0.398
# of Attendance of 3-4 (n=15) and # of Attendance of 8-10 (n=4)	0.044
# of Attendance of 5-6 (n=5) and # of Attendance of 8-10 (n=4)	0.292

$r_s$ : Spearman's rank correlation coefficient

\*\* : reject the null hypothesis that there is no association between the rank pairs with 95% significance

\*\*\*\* : reject the null hypothesis that there is no association between the rank pairs with 99% significance

Under Peterson's facilitation, the consistent tendency of the perceived effectiveness of DCs across the 10 criteria was repeated again with the managers who had attended DCs up to 3-4 times. However,  $r_s$  in table VI-24 shows that this tendency was changed with more experienced user (5-6 or 8-10 decision conferences).

We have repeatedly observed that compared to the other evaluation criteria, DCs were perceived less effective with regard to Accountability of decision (Q7) and Supportability of decision (=implementation, Q8). But, very experienced managers who had attended DCs 8-10 times, rated the DC highly effective with regard to these two criteria (see fig. VI-20). A wild conjecture for the finding is followed. In the previous section, we saw that the decision making process in DCs generally requires a manager to arrive at a decision when he obtains collective agreement to it from his peers or subordinates. This lateral process may contradict the decision taker's accountability. Therefore, implementation of the decision can be hardly improved. This negative perception might be more serious particularly for the first-time attendants. Because they had not experienced such a lateral process before, managers might feel that their accountability and authority were severely damaged, and at the same time they might get confused who were truly accountable for the decision. Therefore, they might reject to execute the action plan when they returned to their job, even though they had ostensibly said yes during the meeting. But, along with the more attendances, managers might become to adapt themselves to this rather unfamiliar process. So, they might become able to find the way to maintain their accountability and authority. At the same time, they might become clear who were truly accountable for the decision. Therefore, they might honestly accept the agreed action plan.

However, p-values in table VI-23 (0.196 for Accountability of decision, and 0.158 for Supportability of decision) and the small number of data ( $n=4$ ) in very experienced users (8-10 decision conferences) limit the interpretation of the results.

More research is required to analyse the relationship between the accountability and implementation of a decision and the extent of prior experiences with DCs.

**(2) Facilitator: Phillips**

Table VI-25 below presents the results of 12 analyses of variance to test the differences in the perceived effectiveness of DCs according to the amount of respondents' prior experiences with DCs, under Phillips' facilitation.

Overall, p-values show that the perceived effectiveness of DCs was independent of the number of DCs a participant had attended, with regard to most of the 12 evaluation criteria. Although, the p-value of Participatory process (Q1) depicts a statistically significant difference in the perceived effectiveness according to the number of DCs a respondent had attended, the overall picture reveals that it does not seem to have a practical importance (see fig. VI-21 below).

**Table VI-25: Results of ANOVA for measures of perceived DC effectiveness differences according to the number of DCs a participant had attended (individual score as a unit of analysis. various co.+ ICL. Phillips. British managers. n =58)**

Criteria for measures of DC effectiveness	1 (n=39)	2 (n=6)	3-4 (n=13)	P - value
Q1. Participatory Process	5.13	4.5	5.92	0.023**
Q2. Data-based Process	5.05	4.5	5.0	0.617
Q3. Adaptable Process	5.59	5.83	5.85	0.641
Q4. Legitimacy of Decision (= decision acceptance)	4.82	5.5	5.15	0.428
Q5. Efficiency of Decision	5.15	6.0	5.46	0.228
Q6. Goal-centred Process	5.32	5.83	5.69	0.413
Q7. Accountability of Decision	4.47	4.5	5.0	0.397
Q8. Supportability of Decision (= implementation)	4.5	4.5	4.46	0.993
Q9. Attitudes: Challenge and Accomplishment	5.08	5.0	5.62	0.286
Q10. Attitudes: Enhancement of Problem-solving Ability	5.97	6.0	5.85	0.901
Q11. Decision Quality: # of alternatives generated	5.72	6.17	5.92	0.385
Q12. Decision Quality: # of criteria considered	5.74	6.33	5.85	0.349

\*\* : statistically significant to reject null hypothesis with 95% credibility

Figure VI-21 below presents graphically the mean values in table VI-25 above. It again shows the inconsistent relationships between the perceived effectiveness of DCs and the number of DCs a respondent had attended, under Phillips' facilitation.

**Figure VI-21: Comparison of perceived DC effectiveness according to the number of DCs a participant had attended (individual score as a unit of analysis. Phillips. various co.+ICL. British managers. n=58)**

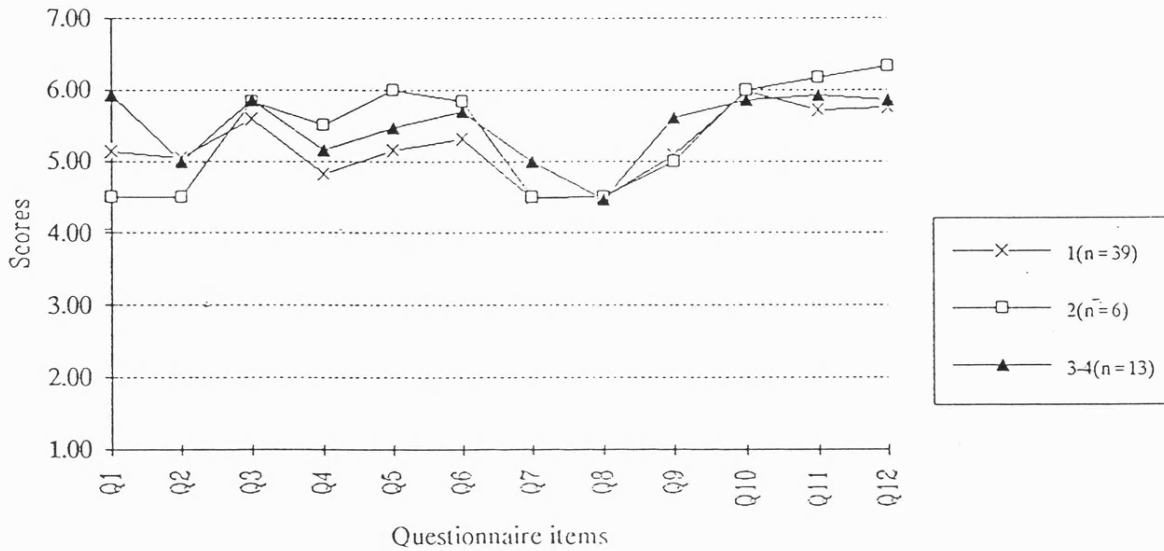


Table VI-26 below shows the correlation between the two groups of rankings of the scores on the 12 criteria, based on the differences in the number of DCs a respondent had attended. Under Phillips' facilitation, the perceived effectiveness of DCs for the 12 criteria shows consistent patterns independent of the differences in the number of DCs a participant had attended.

**Table VI-26: Correlation of the ranks of the scores on the 12 evaluation criteria (under Phillips' facilitation. various co.+ICL. British managers. two-tailed test)**

Correlation of Two # of Attendance	$r_s$
# of Attendance of 1 (n=39) and # of Attendance of 2 (n=6)	0.884****
# of Attendance of 1 (n=39) and # of Attendance of 3-4 (n=13)	0.795****
# of Attendance of 2 (n=6) and # of Attendance of 3-4 (n=13)	0.632**

$r_s$ : Spearman's rank correlation coefficient

\*\* : reject the null hypothesis that there is no association between the rank pairs with 95% significance

\*\*\*\* : reject the null hypothesis that there is no association between the rank pairs with 99% significance

**(3) Facilitator: Hall**

Table VI-27 below presents the results of 12 analyses of variance to test the differences in the perceived effectiveness of DCs according to the amount of respondents' prior experiences with DCs, under Hall's facilitation.

Although the p-value of Decision quality (the number of alternatives generated. Q11) depicts a modestly statistically significant difference in the perceived effectiveness of DCs according to the number of DCs a respondent had attended, other p-values generally show that the perceived effectiveness of DCs was independent of the amount of participants' prior experiences with DCs, with regard to 11 out of 12 evaluation criteria.

**Table VI-27: Results of ANOVA for measures of the perceived DC effectiveness differences according to the number of DCs a participant had attended (individual score as a unit of analysis. ICL. Hall. British managers. n=22)**

Criteria for measures of DC effectiveness	1 (n=13)	2 (n=5)	3-4 (n=4)	P - value
Q1. Participatory Process	4.62	5.0	5.25	0.389
Q2. Data-based Process	5.0	5.6	5.25	0.369
Q3. Adaptable Process	5.23	5.4	5.25	0.956
Q4. Legitimacy of Decision (=decision acceptance)	4.92	5.6	4.75	0.331
Q5. Efficiency of Decision	5.15	5.8	4.75	0.362
Q6. Goal-centred Process	4.92	5.6	5.0	0.525
Q7. Accountability of Decision	4.08	4.4	4.5	0.759
Q8. Supportability of Decision (=implementation)	4.15	4.4	4.25	0.858
Q9. Attitudes: Challenge and Accomplishment	4.46	4.8	4.5	0.863
Q10. Attitudes: Enhancement of Problem-solving Ability	5.85	5.2	6.0	0.266
Q11. Decision Quality: # of alternatives generated	4.85	6.0	6.0	0.068*
Q12. Decision Quality: # of criteria considered	5.46	6.0	5.5	0.497

\* : statistically significant to reject null hypothesis with 90% credibility

Figure VI-22 below provides a visual representation of the table VI-27 above. It again shows the inconsistent relationships between the perceived effectiveness of DCs and the number of DCs a respondent had attended, under Hall's facilitation.

In contrast to Peterson's results, figure VI-22 shows that, with regard to Accountability of decision (Q7) and Supportability of decision (=implementation Q8), the perceived effectiveness of DCs was not dependent upon the number of DCs a respondent had attended.

**Figure VI-22: Comparison of perceived DC effectiveness according to the number of DCs a participant had attended (individual score as a unit of analysis. Hall. ICL. British managers. n=22)**

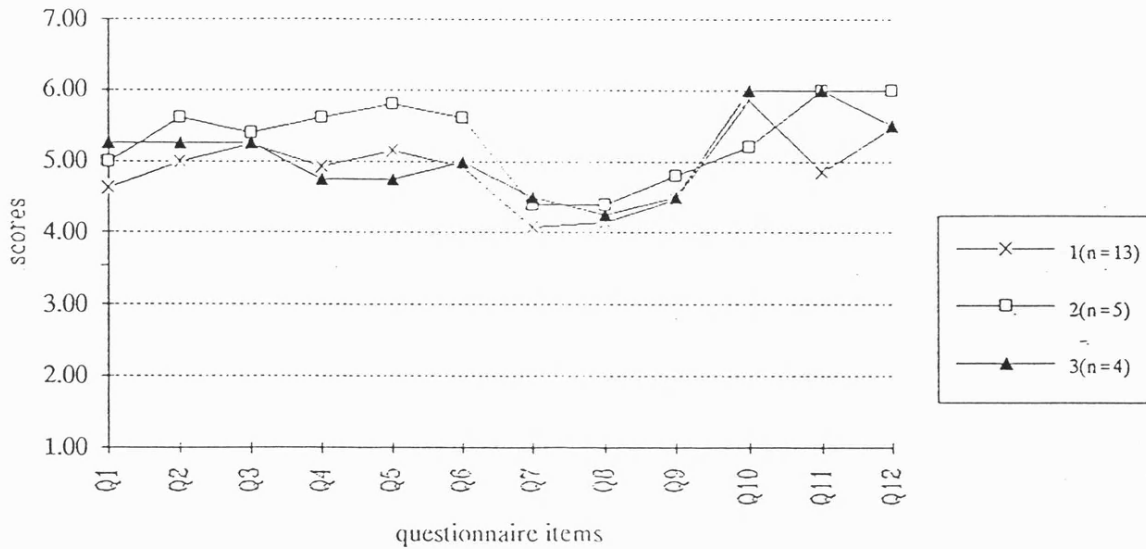


Table VI-28 below shows the correlation between the two groups of rankings of the scores on the 12 criteria, based on the differences in the number of DCs a participant had attended. Under Hall's facilitation, the perceived effectiveness of DCs for the 12 criteria shows consistent patterns independent of the differences in the number of DCs a participant had attended.

**Table VI-28: Correlation of the ranks of the scores on the 12 evaluation criteria (under Hall's facilitation. ICL only. British managers. two-tailed test)**

Correlation of Two # of Attendance	$r_s$
# of Attendance of 1 (n=13) and # of Attendance of 2 (n=5)	0.598**
# of Attendance of 1 (n=13) and # of Attendance of 3-4 (n=4)	0.676**
# of Attendance of 2 (n=5) and # of Attendance of 3-4 (n=4)	0.597**

$r_s$ : Spearman's rank correlation coefficient

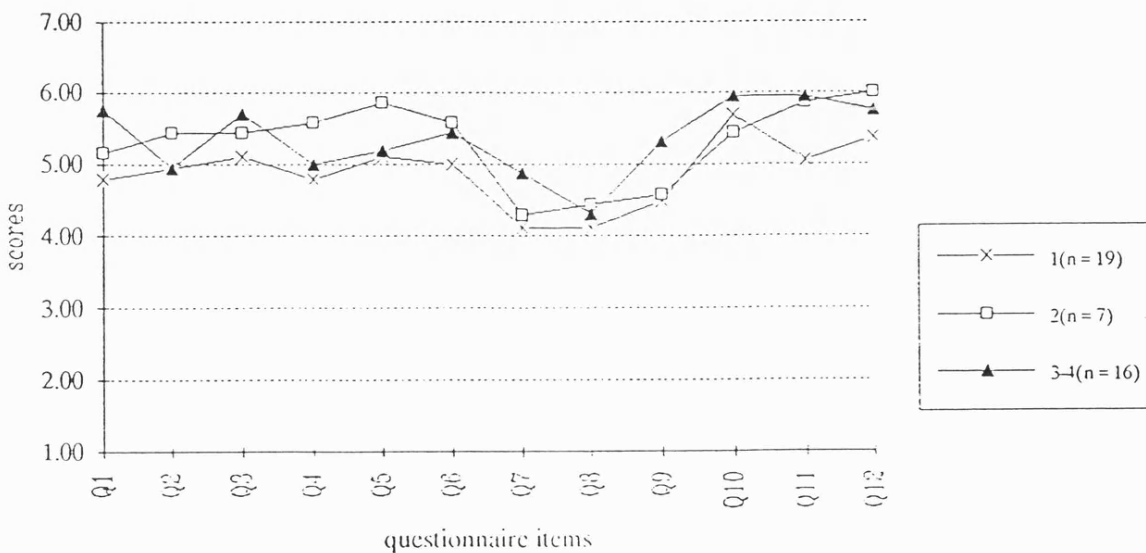
\*\* : reject the null hypothesis that there is no association between the rank pairs with 95% significance

#### (4) ICL only with various facilitators

So far, we've seen that there were little differences in the perceived effectiveness of DCs between the managers who had attended up to 4 DCs. Now, we examine this finding from another angle: the responses from one organisation (ICL) only, for DCs which were conducted by Phillips, Hall, and Wooler. This analysis test the hypothesis that there is a small experience effect, but it has been masked in previous analysis by between-company variability. Thus, this analysis draws on data from only one company.

Figure VI-23 below presents graphically the relationship between the ICL managers' perception of the effectiveness of DCs and the number of DCs they had attended. It again shows the inconsistent relationships between the perceived effectiveness of DCs and the number of DCs a respondent had attended. No consistent prior experience effect is evident.

**Figure VI-23: Comparison of perceived effectiveness of DCs according to the number of DCs a participant had attended (individual score as a unit of analysis. ICL only. Phillips, Hall, and Wooler. British managers. n = 42)**



### 6.6.3. Summary

(1) GDSS research has repeatedly reported that some learning from repeated use of the GDSS is required before achieving improved performance and satisfaction, if the system requires users to access the system by themselves, irrespective of whether it is a user-, chauffeur-, or facilitator-driven GDSS.

(2) Unlike the results from the study of user-access type GDSSs, the present study shows that there were little differences in the perceived effectiveness of DCs (analyst-access type GDSSs) between the managers who had attended up to 4 DCs.

(3) Therefore, the generalisation of the problems of technical unfamiliarity found in the initial use of user-access type GDSSs, can not be applied to user-free type GDSSs.

(4) Independent of the variables investigated so far, we have observed that the perceived effectiveness of DCs represents consistent patterns for most of the 12 evaluation criteria. Table VI-24, -26, and -28 above summarise the correlation ( $r_s$ ) between the two groups of rankings of the scores on the 12 criteria (in case of Peterson, 10), based on the differences in the number of DCs a participant had attended. They altogether indicate that this tendency was still unchanged with the managers who had attended up to 4 DCs.

(5) However,  $r_s$  in table VI-24 shows that under Peterson's facilitation, the tendency was changed with the managers who had attended 5-6 or 8-10 DCs. For example, DCs have been consistently perceived less effective with regard to Accountability of decision (Q7) and Supportability of decision (Q8). But, managers who had attended 8-10 DCs rated the effectiveness of DCs highly with regard to those two criteria. A possible rough guess for the unexpected finding might be as follows. We saw that the decision making process in DCs generally requires a manager to arrive at a decision when he obtains collective agreement to it from his peers or subordinates. This lateral process may contradict the decision taker's accountability. This negative perception might be more serious particularly for the first-time attendants. Because they had not experienced such a lateral process before, managers might feel that their accountability and authority were severely damaged, and at the same time they might get confused who were truly accountable for the decision. Therefore, they might reject to execute the action plan when they returned to their job, even though they had ostensibly said yes during the meeting. But, along with more experiences, managers might become to adapt themselves to this rather unfamiliar process. So, they might



become able to find the way to maintain their accountability and authority. At the same time, they might become clear who were truly accountable for the decision. Therefore, they might honestly accept the agreed action plan. However, weak p-values and the small number of data ( $n=4$ ) in very experienced users (8-10 DCs) limit the interpretation of the results. More research is required to analyse the relationship between the accountability and implementation of a decision and the amount of prior experiences with DCs.

## 6.7. Participants' Main Careers in Their Working Lives

In this section, I test the hypothesis that a person's career affects its perceptions of the effectiveness of a DC. For example, managers from engineering, compared with, say, managers from personnel, might consider the effectiveness of DCs quite differently. I started with no specific views about the nature of this effect, and wanted simply to explore the data to see if career-associated differences existed.

I, therefore, examine the differences in the perceived effectiveness of DCs according to the respondents' main careers. I asked participants on their questionnaires in what functional areas of business they had spent most of their career. The managers in this study ranged in managerial experience from 7 to 46 years with average 24 years, in current organisation tenure from 6 months to 38 years with average 13 years, and in current job tenure from 3 months to 14 years with average 3 years. Table VI-29 below classifies the respondents according to their main functional areas in their whole working lives. Unfortunately, the data size available from the returned questionnaires was not big enough to allow us to analyse the effect of all of the 10 areas of the main careers on perceived effectiveness of DCs. For example, under Peterson's facilitation, only one person worked in public relations, whereas 15 people replied that their main careers were related with marketing or sales. So, tests were carried out only for careers with more than 5 respondents. Inevitably, the interpretation of the findings in this section is affected by this limitation.

**Table VI-29: Analysis of respondents according to their main careers in their working lives**

Main Careers	Peterson	Phillips	Hall
1. marketing, sales	15	26	11
2. finance	5	8	2
3. engineering	9	3	3
4. R & D		3	6
5. general administration	6	7	1
6. education, consulting	1	8	
7. personnel	14	2	1
8. government	1		
9. public relations	1	3	
10. broadcasting (TV news)	5		
Total	57	60	24

### 6.7.1. Facilitator: Peterson

Table VI-30 below presents the results of 10 analyses of variance to test the differences in the perceived effectiveness of DCs according to the variety of respondents' main functional areas of business, under Peterson's facilitation.

The results of statistical analysis (p-values) show that the perceived effectiveness of DCs was independent of the variety of respondents' main careers, for all of the 10 evaluation criteria. Under Peterson's facilitation, there were very little differences in the perceived effectiveness of DCs between the managers from different areas of business, whether they were from marketing and sales, engineering, general administration, or personnel.

**Table VI-30: Results of ANOVA for measures of perceived DC effectiveness differences according to respondents' main functional area of business in their whole working lives (individual score as a unit of analysis. WH+TV. Peterson. American managers)**

Criteria for measures of DC effectiveness	marketing, sales (n = 15)	engineering (n = 9)	general administration (n = 6)	personnel (n = 14)	P-value
Q1. Participatory Process	5.60	6.00	6.17	5.57	0.705
Q2. Data-based Process	5.87	6.11	5.83	5.93	0.942
Q3. Adaptable Process	6.13	6.33	6.33	6.14	0.913
Q4. Legitimacy of Decision	5.60	5.11	5.33	5.93	0.510
Q5. Efficiency of Decision	6.07	6.00	5.50	6.07	0.728
Q6. Goal-centred Process	6.00	6.11	5.67	6.07	0.780
Q7. Accountability of Decision	5.40	5.78	4.83	5.50	0.666
Q8. Supportability of Decision	5.13	4.78	4.50	5.43	0.523
Q9. Attitudes: Challenge and Accomplishment	5.67	6.00	5.33	5.79	0.696
Q10. Attitudes: Enhancement of Problem-solving Ability	6.20	6.22	6.17	6.36	0.937

Figure VI-24 below presents graphically the values in table VI-30 above. Reflecting the magnitude of p-values in table VI-30, it shows little differences in the perceived effectiveness of DCs between the managers with different careers.

**Figure VI-24: Comparison of perceived DC effectiveness according to respondents' main functional area of business in their whole working lives (individual score as a unit of analysis. WH+TV. Peterson. American managers)**

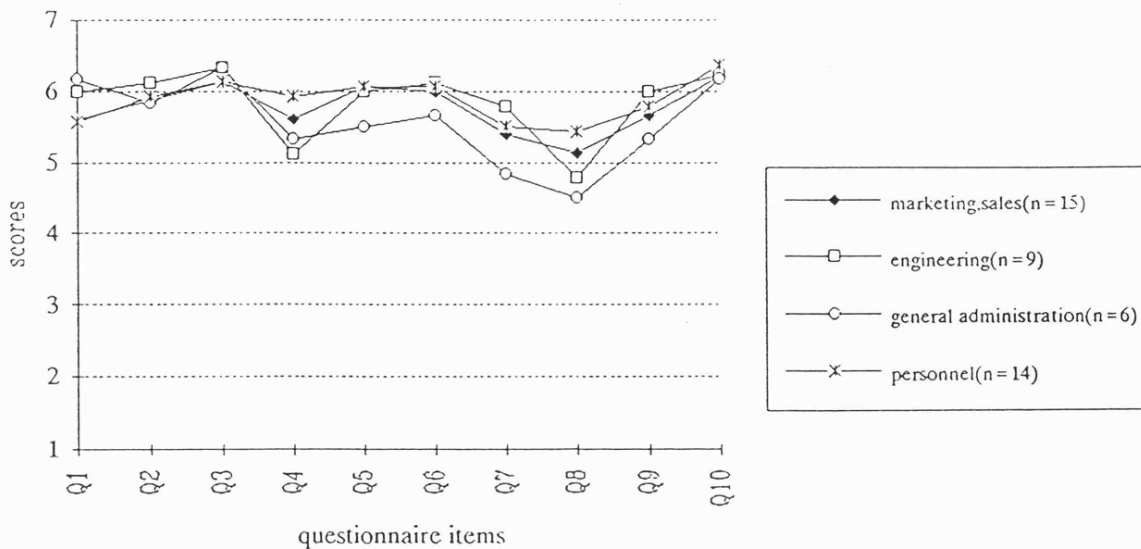


Table VI-31 below shows the correlation between the two groups of rankings of the scores on the 10 criteria, based on the differences in the respondents' main careers. Under Peterson's facilitation, the perceived effectiveness of DCs for the 10 criteria shows consistent patterns independent of the differences in respondents' main functional areas of business.

**Table VI-31: Correlation of the ranks of the scores on the 10 evaluation criteria (under Peterson's facilitation. WH+TV. American managers. two-tailed test)**

Correlation of Two Main Careers	$r_s$
marketing,sales (n=15) and engineering (n=9)	0.883****
marketing,sales (n=15) and general administration (n=6)	0.746***
marketing,sales (n=15) and personnel (n=14)	0.963****
engineering (n=9) and general administration (n=6)	0.873****
engineering (n=9) and personnel (n=14)	0.811****
general administration (n=6) and personnel (n=14)	0.702**

$r_s$ : Spearman's rank correlation coefficient

\*\* : reject the null hypothesis that there is no association between the rank pairs with 95% significance

\*\*\* : reject the null hypothesis that there is no association between the rank pairs with 98% significance

\*\*\*\* : reject the null hypothesis that there is no association between the rank pairs with 99% significance

### 6.7.2. Facilitator: Phillips

Table VI-32 below presents the results of 12 analyses of variance to test the differences in the perceived effectiveness of DCs according to the variety of respondents' main careers, under Phillips' facilitation.

Again, p-values show that the perceived effectiveness of DCs was independent of the variety of respondents' main careers for all of the 12 evaluation criteria. Under Phillips' facilitation, there were very little differences in the perceived effectiveness of DCs between the managers from different areas of business, whether they were from marketing and sales, finance, general administration, or education and consulting.

**Table VI-32: Results of ANOVA for measures of perceived DC effectiveness differences according to respondents' main functional area of business in their whole working lives (individual score as a unit of analysis. various co. + ICL. Phillips. British managers)**

Criteria for measures of DC effectiveness	marketing, sales (n=26)	finance (n=8)	general administration (n=7)	education, consulting (n=8)	P-value
Q1. Participatory Process	5.46	5.25	5.29	4.88	0.704
Q2. Data-based Process	4.81	5.38	4.86	4.63	0.684
Q3. Adaptable Process	5.77	5.50	5.43	5.63	0.840
Q4. Legitimacy of Decision	5.27	4.00	4.83	4.75	0.130
Q5. Efficiency of Decision	5.27	5.25	5.00	5.50	0.884
Q6. Goal-centred Process	5.50	5.13	5.33	5.25	0.864
Q7. Accountability of Decision	4.85	4.75	4.33	4.38	0.644
Q8. Supportability of Decision	4.65	4.00	4.00	4.63	0.312
Q9. Attitudes: Challenge and Accomplishment	5.27	4.88	5.29	4.75	0.607
Q10. Attitudes: Enhancement of Problem-solving Ability	5.92	5.88	5.71	6.00	0.947
Q11. Decision Quality: # of alternatives generated	5.96	5.63	5.43	5.88	0.272
Q12. Decision Quality: # of criteria considered	5.96	5.63	5.43	5.75	0.527

Figure VI-25 below presents graphically the values in table VI-32 above.

Although there is a some variation in the perceived effectiveness of DCs with regard to Legitimacy of decision (=decision acceptance Q4) between the managers from different working background (especially those with finance background), it generally shows little differences with regard to most of other 11 evaluation criteria. The slightly lower scores on the Legitimacy of decision (=decision acceptance Q4) by finance people might be due to the heavy reliance on judgement rather than financial projection in modelling the problem.

Figure VI-25: Comparison of perceived DC effectiveness according to respondents' main functional area of business in their whole working lives (individual score as a unit of analysis. various co.+ ICL. Phillips. British managers)

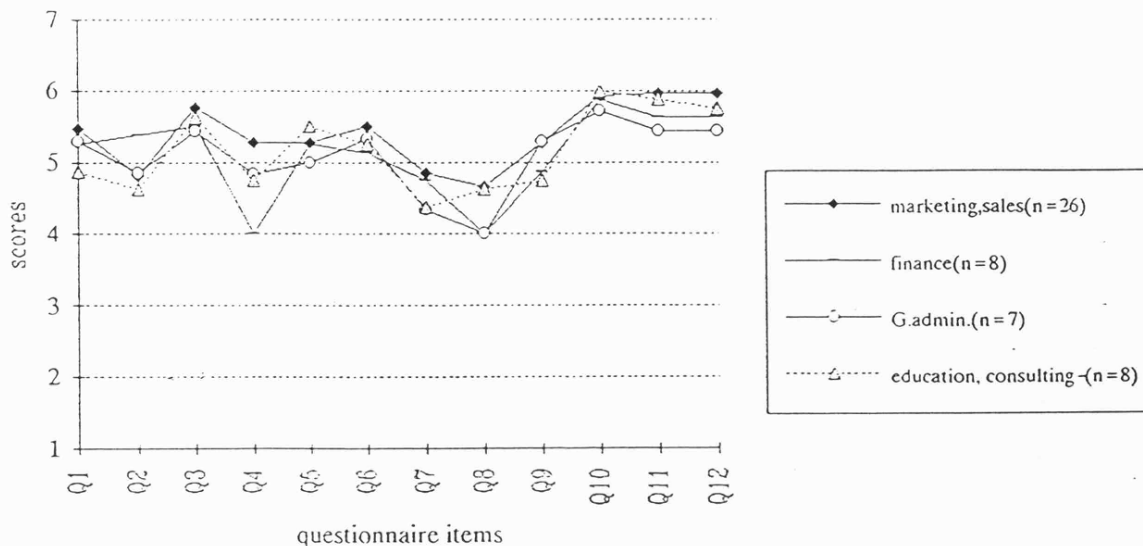


Table VI-33 below shows the correlation between the two groups of rankings of the scores on the 12 criteria, based on the differences in the respondents' main working careers. Like the case of Peterson's, the perceived effectiveness of DCs for the 12 criteria under Phillips' facilitation shows consistent patterns independent of the differences in respondents' main functional areas of business.

Table VI-33: Correlation of the ranks of the scores on the 12 evaluation criteria (under Phillips' facilitation. various co.+ ICL. British managers. two-tailed test)

Correlation of Two Main Careers	$r_s$
marketing,sales (n=26) and finance (n=8)	0.762***
marketing,sales (n=26) and general administration (n=7)	0.925****
marketing,sales (n=26) and consulting, education (n=8)	0.912****
finance (n=8) and general administration (n=7)	0.863****
finance (n=8) and consulting, education (n=8)	0.826****
general administration (n=7) and consulting, education (n=8)	0.926****

$r_s$ : Spearman's rank correlation coefficient

\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 98% significance

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

### 6.7.3. Facilitator: Hall

Table VI-34 below presents the results of 12 analyses of variance to test the differences in the perceived effectiveness of DCs according to the variety of respondents' careers, under Hall's facilitation.

In contrast to the results of Peterson's and Phillips', p-values show that the perceived effectiveness of DCs was dependent of the variety of respondents' main careers with regard to 9 out of 12 evaluation criteria.

**Table VI-34: Results of two sample T-test for measures of perceived DC effectiveness differences according to respondents' main functional area of business in their whole working lives (individual score as a unit of analysis. ICL. Hall. British managers)**

Criteria for measures of DC effectiveness	marketing, sale (n=11)	R & D (n=6)	P-value
Q1. Participatory Process	4.91	4.00	0.035**
Q2. Data-based Process	5.27	4.50	0.034**
Q3. Adaptable Process	5.36	4.83	0.33
Q4. Legitimacy of Decision	5.55	4.33	0.040**
Q5. Efficiency of Decision	5.64	4.33	0.027**
Q6. Goal-centred Process	5.36	4.00	0.027**
Q7. Accountability of Decision	4.91	3.50	0.0077**
Q8. Supportability of Decision	4.64	3.67	0.0094**
Q9. Attitudes: Challenge and Accomplishment	4.45	4.33	0.83
Q10. Attitudes: Enhancement of Problem-solving Ability	5.73	5.33	0.40
Q11. Decision Quality: # of alternatives generated	5.82	4.17	0.047**
Q12. Decision Quality: # of criteria considered	5.82	5.17	0.019**

\*\* : statistically significant to reject the null hypothesis with 95% credibility

Table VI-34 tells us that under Hall's facilitation, the perceived effectiveness of DCs of marketing or sales managers was clearly higher than that of R & D managers (see fig. VI-26 below). Note that we have observed the perceived effectiveness of DCs is greater at higher levels in the executive hierarchy. Two sets of data in this analysis, however, were identical to each other in terms of organisation and stratum; they were all ICL managers, and 10 out of 11 people with the marketing or sales background rated their strata as III-IV, and 5 out of 6 managers with R & D background also thought their strata as III-IV.

**Figure VI-26: Comparison of perceived DC effectiveness according to respondents' main functional area of business in their whole working lives (individual score as a unit of analysis. ICL. Hall. British managers)**

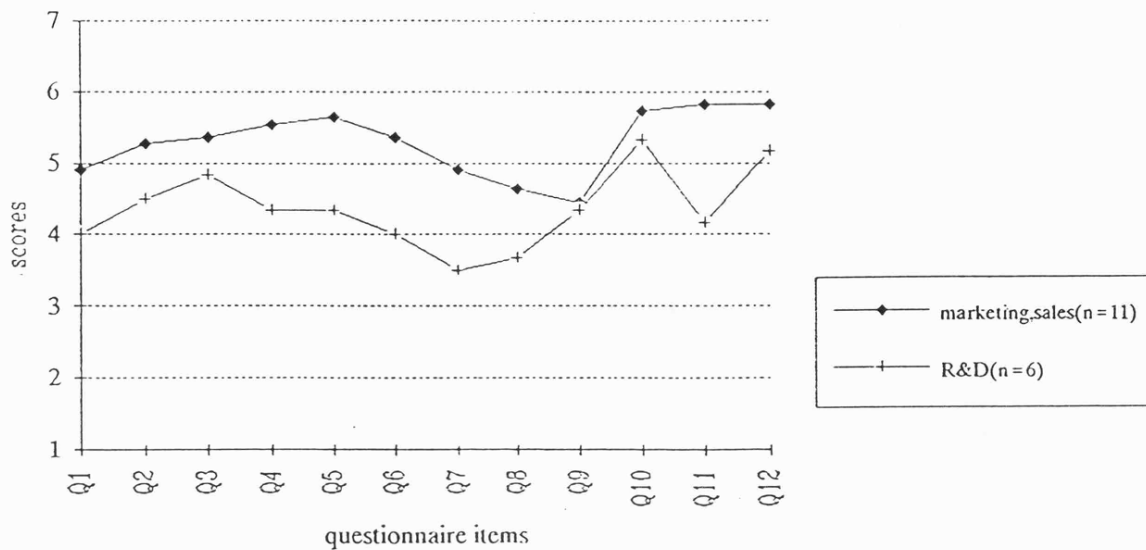


Figure VI-26 shows that under Hall's facilitation, there was a discernible difference in the perceived effectiveness of DCs between the marketing or sales managers and R & D managers with regard to 11 out of the 12 evaluation criteria.

However, as we can see from table VI-35 below, under Hall's facilitation, the perceived effectiveness of DCs for the 12 criteria again shows consistent patterns between the managers from marketing or sales background and those with R & D background.

**Table VI-35: Correlation of the ranks of the scores on the 12 evaluation criteria (under Hall's facilitation. ICL only. British managers. two-tailed test)**

Correlation of Two Main Careers	$r_s$
marketing,sales (n=11) and R&D (n=6)	0.535*

$r_s$ : Spearman's rank correlation coefficient

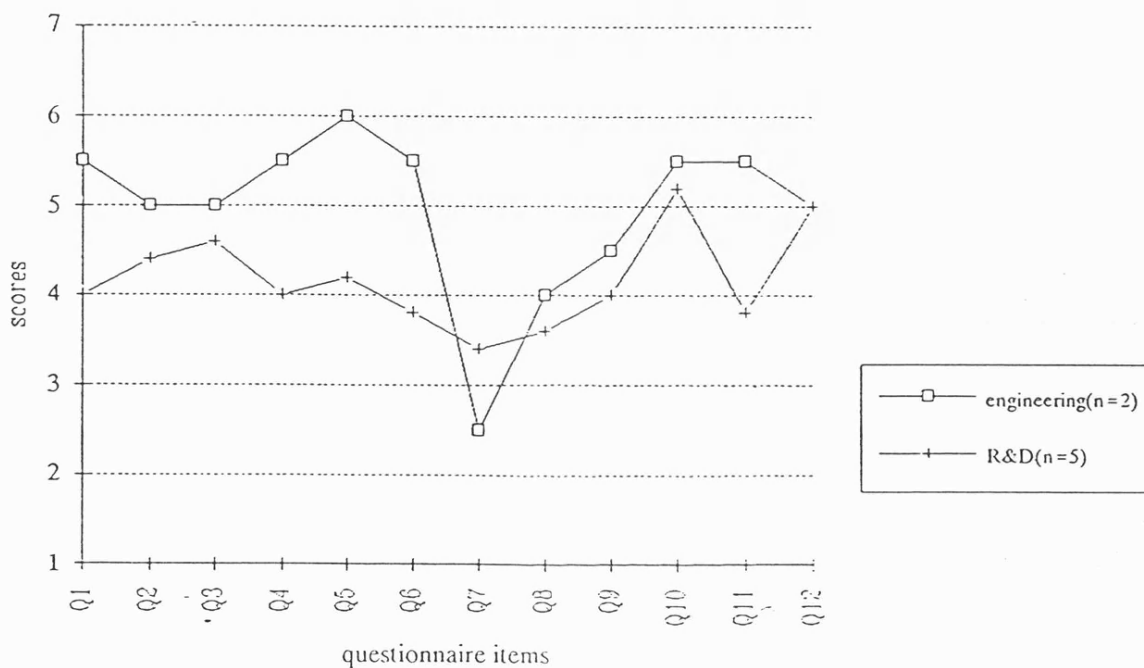
\*: reject the null hypothesis that there is no association between the rank pairs with 90% significance

We need to examine the present finding from another angle. The 11 marketing or sales people were from 3 DCs (2, 4, and 5 people in each DC), but 5 out of 6 R & D people were from only 1 DC. That particular DC might be just a poor one. If so, the present result is not necessarily attributable to career differences.



Let's call that particular DC as "KG." There were 7 respondents from "KG": 2 engineering people with strata II-III, 4 R & D people with strata II-III, and 1 R & D people with stratum IV. So, there were little stratum differences between engineering managers and R & D managers in "KG." Figure VI-27 below shows the differences in the perceived effectiveness of the DC between R & D managers and engineering managers, all were in one decision conference "KG." It depicts that the scores of R & D managers were lower than those of engineering managers with regard to 11 out of 12 criteria.

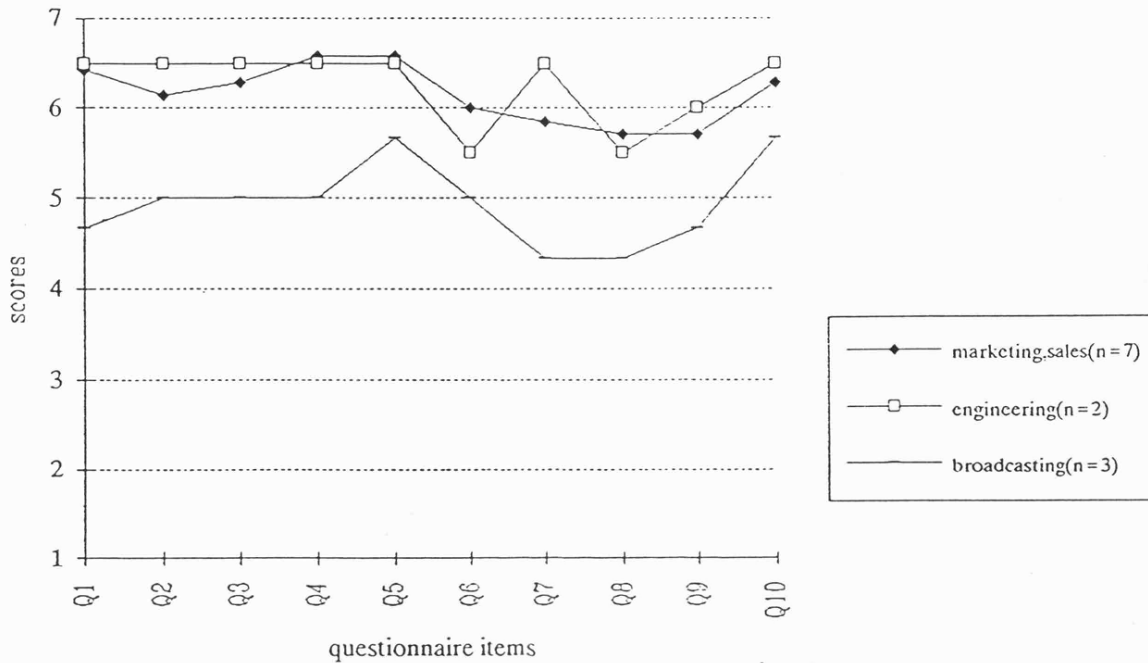
**Figure VI-27: Comparison of perceived DC effectiveness between R & D managers and engineering managers in one decision conference "KG" (individual score as a unit of analysis. ICL. Hall. British managers)**



"KG" might be a particularly unsuccessful DC. However, there were still differences in the perceived effectiveness of DCs between the engineering managers and R & D managers in that DC.

The career-associated differences were also found in one of the Peterson's DCs. Let's call the DC as "ZD." Figure VI-28 below shows the differences in the perceived effectiveness of the DC between marketing or sales, engineering, and broadcasting (TV news) people, all were in one decision conference "ZD." It depicts that the scores of broadcasting (TV news) managers were lower than those of marketing or sales, and engineering managers with regard to all of the 10 evaluation criteria.

**Figure VI-28: Comparison of perceived DC effectiveness between marketing or sales, engineering, and broadcasting (TV news) managers in one decision conference "ZD" (individual score as a unit of analysis. WWOR-TV. Peterson. American managers)**



Although fig. VI-26, -27, and -28 above show the existence of career-associated differences in the perception of the effectiveness of a DC, I must stress that further study would be needed to explore the career-associated effect on the perception in light of such a small sample sizes used in this section. In the mean time, present pilot finding shows that a career effect on the perception of the effectiveness of a DC can not be ruled out.

#### 6.7.4. Comparison between facilitators: marketing or sales managers' perception of the effectiveness of DCs

We have observed that the perceived effectiveness of DCs were different from each other according to the variety of facilitators, but the tendency of the effectiveness was consistent for the 12 (in case of Peterson's, 10) evaluation criteria irrespective of the variables investigated so far.

Now, we test the verification of these findings using more controlled data: respondents from the same career, those are managers with marketing or sales working career. The reason to choose this career particularly is that the data size of the career is only fairly big enough from the 10 careers examined for the subsequent analysis (see table VI-29 earlier).

Table VI-36 and figure VI-29 below together show the differences across three facilitators in the perceived effectiveness of DCs by the managers with marketing or sales working background. Although figure VI-29 shows the scores under Peterson's facilitation are higher than those under the other two facilitators for all of the 10 criteria, p-values in table VI-36 reveal that Peterson's facilitation was perceived discernibly better than Phillips' with regard to only 2 criteria: Data-based process (Q2), and Efficiency of decision (Q5), and it was also perceived discernibly better than Hall's with regard to only 4 criteria: Data-based process (Q2), Adaptable process (Q3), Goal-centred process (Q6), and Attitudes (challenge and accomplishment Q9). But, remember that using the scores obtained from the managers in all of the 10 business areas, we previously saw that Peterson's facilitation was perceived with statistical significance better than the other two facilitators' with regard to 9 out of the 10 evaluation criteria (see table VI-1).

Figure VI-29 also shows that there were almost no distinctive differences in the effectiveness measures of DCs between the marketing or sales managers under Phillips' facilitation and those under Hall's facilitation; Phillips' facilitation was rated better than Hall's with regard to Participatory process (Q1), Adaptable process (Q3), and Attitudes: challenge and accomplishment (Q9), whereas Hall's facilitation was perceived better than Phillips' with respect to Data-based process (Q2), Legitimacy of decision (Q4), and Efficiency of decision (Q5). Both facilitations were all much the same in the scores with regard to the rest of the criteria (Q6, Q7, Q8, Q10, Q11, and Q12). However, based on the scores obtained from the managers in all of the 10 business areas, we previously saw that Phillips' facilitation was perceived better than Hall's across 9 out of 12 criteria, and

both facilitations were all much the same in the scores with regard to Data-based process (Q2), Legitimacy of decision (Q4), and Efficiency of decision (Q5) (see fig. VI-30).

P-values in table VI-36 also reveal that Phillips' facilitation was perceived discernibly better than Hall's with regard to only 1 out of 12 criteria: Attitudes in terms of challenge and accomplishment (Q9). Again, using the scores obtained from the managers in all of the 10 business areas, however, we previously saw that Phillips' facilitation was perceived with statistical significance better than Hall's with regard to 4 out of 12 criteria: Participatory process (Q1), Adaptable process (Q3), Attitudes in terms of challenge and accomplishment (Q9), and Decision quality in terms of the number of alternatives generated (Q11).

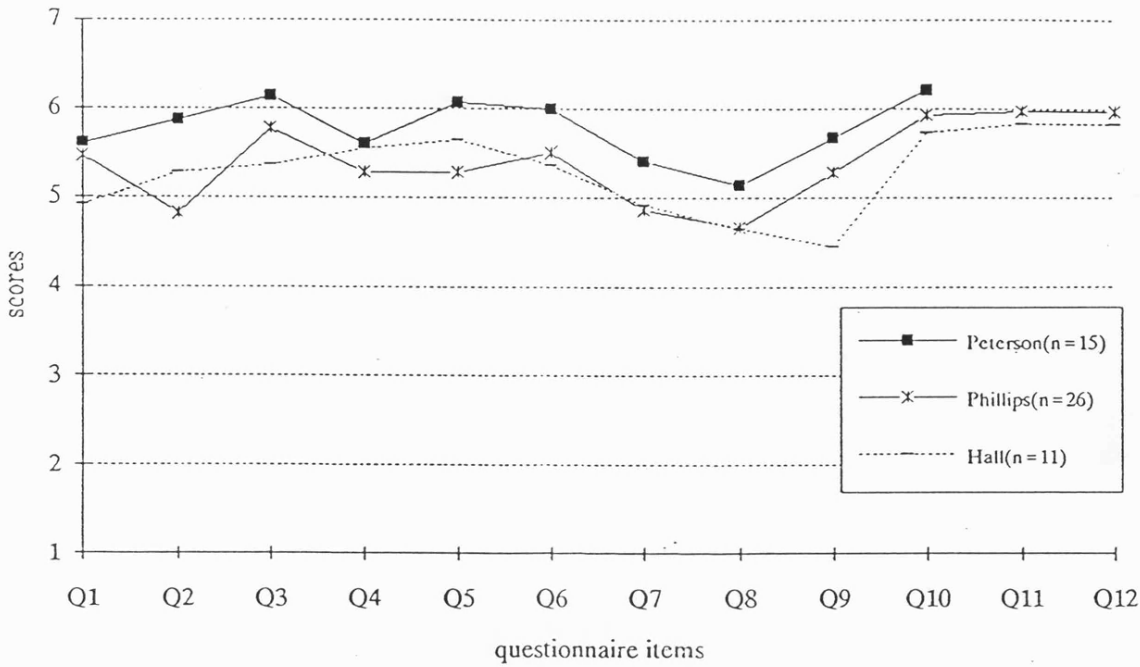
**Table VI-36: Results of two sample T-test for measures of the differences across facilitators in the perceived effectiveness of DCs by the marketing or sales managers (individual score as a unit of analysis. various co. American + British managers)**

Criteria for measures of DC effectiveness	Peterson (n = 15)	Phillips (n = 26)	Hall (n = 11)	P-values		
				Peterson vs. Phillip	Peterson vs. Hall	Phillips vs. Hall
Q1. Participatory Process	5.6	5.46	4.91	0.76	0.16	0.16
Q2. Data-based Process	5.87	4.81	5.27	0.0086**	0.10*	0.22
Q3. Adaptable Process	6.13	5.77	5.36	0.17	0.06*	0.32
Q4. Legitimacy of Decision	5.6	5.27	5.55	0.51	0.91	0.49
Q5. Efficiency of Decision	6.07	5.27	5.64	0.032**	0.19	0.27
Q6. Goal-centred Process	6	5.5	5.36	0.16	0.044**	0.69
Q7. Accountability of Decision	5.4	4.85	4.91	0.23	0.28	0.86
Q8. Supportability of Decision	5.13	4.65	4.64	0.28	0.28	0.96
Q9. Attitudes: Challenge and Accomplishment	5.67	5.27	4.45	0.26	0.014**	0.079*
Q10. Attitudes: Enhancement of Problem-solving Ability	6.2	5.92	5.73	0.29	0.21	0.58
Q11. Decision Quality: # of alternatives generated	xxx	6.96	5.82	xxx	xxx	0.54
Q12. Decision Quality: # of criteria considered	xxx	5.96	5.82	xxx	xxx	0.58

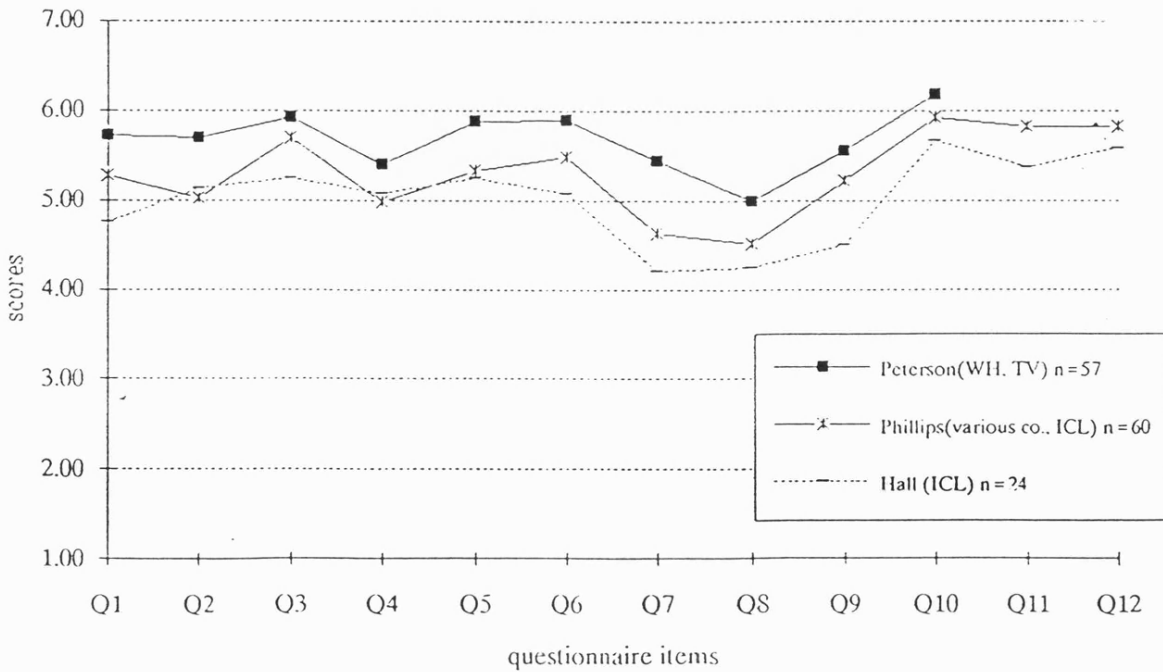
\* : reject the null hypothesis that there is a no difference between two groups with 90% credibility

\*\* : reject the null hypothesis that there is a no difference between two groups with 95% credibility

**Figure VI-29: Comparison of the perceived effectiveness of DCs across facilitators**  
 (individual score as a unit of analysis. various co. American + British managers  
 in only marketing or sales working background. n = 52)



**Figure VI-30: Comparison of the perceived effectiveness of DCs across facilitators**  
 (individual score as a unit of analysis. various co. American + British managers  
 in all of 10 careers. n = 141. reproduced from figure VI-3)



The results in this section show that facilitator-associated effect on the differences in the marketing or sales managers' perception of the effectiveness of DCs was much less than that of the managers in all of the 10 business areas. In particular, there were almost no dominations in the perception of the effectiveness of DCs for the 12 criteria between the marketing or sales managers under Phillips' facilitation and those under Hall's facilitation, whereas we previously saw that Phillips' facilitation was perceived better than Hall's with regard to 9 out of 12 criteria by the average managers in all of the 10 business areas. As we saw from figure VI-26 earlier, the relative low scores in Hall's facilitation compared to the other two facilitators', were mainly attributable to the R & D managers' particularly low perception of the effectiveness of DCs compared to the managers in other careers. Like the pilot conclusion in the previous section, present finding again shows that a career effect on the perception of the effectiveness of a DC can not be ruled out.

Figure VI-29 also reveals that the perceived effectiveness of DCs by the marketing or sales managers has consistent patterns for the 12 (in case of Peterson, 10) criteria, irrespective of the variety of facilitators. Spearman's rank correlation coefficient of the rankings of the scores on the 12 (or 10) criteria between the facilitators supports the finding with statistical significance (see table VI-37 below).

**Table VI-37: Correlation of the ranks of the scores on the 12 (or 10) evaluation criteria, obtained from the managers with marketing or sales career (various co. American + British managers. two-tailed test)**

Correlation of Two Facilitators	$r_s$
Peterson (n=15) and Phillips (n=26) on the 10 criteria	0.745***
Peterson (n=15) and Hall (n=11) on the 10 criteria	0.706**
Phillips (n=26) and Hall (n=11) on the 12 criteria	0.831****

$r_s$ : Spearman's rank correlation coefficient

\*\* : reject the null hypothesis that there is no association between the rank pairs with 95% significance

\*\*\* : reject the null hypothesis that there is no association between the rank pairs with 98% significance

\*\*\*\* : reject the null hypothesis that there is no association between the rank pairs with 99% significance

The results in previous sections and this one together show that the perception of the effectiveness of DCs is affected not only by the variety of facilitators but also the differences in participants themselves in terms of their strata in the organisation, and their main functional areas in the business.

### 6.7.5. Summary

(1) The sample sizes were not big enough to allow us to analyse the effect of all of the 10 main careers of participants on their perceived effectiveness of DCs. So, the test has been carried out only for careers with more than five respondents. Therefore, the interpretation of the findings in this section was restricted by this limitation.

(2) Under Peterson's facilitation, there was very little difference in the perceived effectiveness of DCs for most of the 10 evaluation criteria between the managers from marketing or sales, engineering, general administration, and personnel background.

(3) Under Phillips' facilitation, there was again very little difference in the perception of the effectiveness of DCs for most of the 12 evaluation criteria between the managers from marketing or sales, finance, general administration, and education and consulting background.

(4) Under Hall's facilitation, however, the perceived effectiveness of DCs of the ICL managers at strata III-IV with marketing or sales background was clearly higher than that of the identical managers with R & D background.

Although several findings above show the existence of career-associated differences in the perception of the effectiveness of a DC, I must stress that further study would be needed to explore the career-associated effect on the perception in light of such a small sample sizes used in this study. In the mean time, present pilot findings show that a career effect on the perception of the effectiveness of a DC can not be ruled out.

(5) Table VI-29, -31, -33, and -35 above summarise the correlation ( $r_s$ ) between the two groups of rankings of the scores on the 12 criteria (in case of Peterson, 10), based on the differences in the respondents' main functional areas of business. They altogether indicate that the perception of the effectiveness of DCs for the 12 (or 10) evaluation criteria shows consistent patterns independent of the differences in respondents' careers.

## 6.8. Task Differences

Virtually most of group dynamics researchers agree that the nature of the task the group confronts is one of the most important factors in influencing group performance (Fisher, 1981; Hackman & Morris, 1975; Hare, 1976; McGrath, 1984; Shaw, 1981). Because task determines the need for information and the consequent interaction practices of the group, people studying groups have always tried to classify tasks in ways that relate meaningfully to how groups perform them. Good review of classifications of tasks is provided elsewhere (Goodman, 1986; McGrath, 1984; Shaw, 1981).

GDSS researchers have also attempted to investigate the effect of tasks on how computer support is viewed and used. Shaw (1981) argues that the level of task complexity is a fundamental factor in influencing the performance of the group. So, some GDSS researchers (Bui & Sivasankaran, 1990; Dennis et al., 1988; Gallupe, 1986; Gallupe et al., 1988; Gallupe & McKeen, 1990) have examined the effect of a GDSS use on the meeting outcomes with varying the degree of task difficulty. They all have found that use of a GDSS has more positive effects on the meeting outcomes when dealing with more difficult tasks compared to less difficult ones.

Other researchers mainly from the University of Minnesota have investigated the effect of GDSS use on the group performance by varying the extent and type of a particular activity inherent in each phase in decision-making process (e.g., problem finding, choice, consensus reaching, and etc.). This is based on the assumption that decision making occurs in phases- that at any one point in the decision process, a particular type of decisional activity dominates all the others (Lyles, 1981; Mintzberg et al., 1976; Pounds, 1969). These *phase theorists*\* have described the decision process as involving a number of distinct phases (such as problem finding, solution generation, and choice). But, they do not claim that decision making is simple or orderly. In place of a simple sequential relationship, they describe a process involving feedback cycles, interrupts, and numerous subroutines. Anyhow, they imply (1) that one type of activity dominates others at any point in the decision process and (2) that decision-makers' attention is focused on one phase at a time. A detailed review of

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\* However, some organisational theorists (Anderson, 1983; Witte, 1972) have questioned the existence of stages and have found no evidence for the "phase theorem" that decision makers focused on one particular kind of decisional activity at any point in the decision process. Instead, they have found that four major types of decisional activities (information gathering, alternatives development, alternative evaluation, and alternative selection) occurred simultaneously, with approximately equal frequency, throughout the decision process (Schwenk, 1988. chapter 3).



alternative organisational decision-making process models is beyond the scope of this section. However, discussions of the major models may be found in several reviews (Allison, 1971; Lang et al., 1978; Schwenk, 1988).

Many laboratory GDSS experiments have been carried out based on the assumption of "phase theorem (Witte, 1972)." For example, GDSS has been reported to have positive effect on the decision quality over manual or no support method in dealing with the problem finding task (Gallupe et al., 1988), and idea generation task (Lewis, 1982). But it has been found to show little advantage in improving decision quality over manual structured support in tackling choice task (Bui et al., 1987; Zigurs et al., 1988), and preference reconciliation (resolving conflicts and obtaining consensus) task (Beauclair, 1987; Gallupe, 1990; Gallupe & McKeen, 1990; Watson et al., 1988). However, Jarvenpaa et al. (1988) have reported that GDSS shows the advantage in improving decision quality over the baseline treatment in dealing with choice task. Zigurs et al. (1988) suggest that the extent and type of structure inherent in the task (that a particular type of decisional activity inherent in each phase of decision making process) appear to affect the way in which groups use the technological support provided. They conclude that the effectiveness of a group's adaptation of support technology is partially a function of the match between the group's view of task demands and its view of the technology. That is, the key to significant effectiveness increases in computer support of groups may be in both the adaptability of the system to the task and the adaptability of the group in their view of the system's utility and meaning.

As I mentioned earlier, however, the findings from experimental laboratory settings with controlling the type of task as mentioned above may suggest little insight to the application of GDSS to external world. The reasons are:

- (1) All of the tasks addressing the aid of a GDSS in real world setting cannot be easily distinguished by the degree of task difficulty. Because all of them are uniquely difficult, they are brought to receive the aid of a GDSS. Executives do not have time to play with GDSS to handle easy and trivial tasks. So, it may be almost impossible (or meaningless) for us to investigate the effects of a GDSS with controlling the degree of task difficulty in real world setting. And,
- (2) Much of a senior manager's work is concerned with evaluating options and allocating resources in light of conflicting objectives and uncertainty about the future (Phillips, 1988). This type of task always requires managers to exercise all of the major types of decisional activities (information gathering, alternatives development, alternative evaluation, consensus reaching, and alternative selection) together.

Furthermore, as even proponents of phase theorem have pointed out, people may not simply follow the decision process sequentially; they may take a great deal of cycling between phases, in other words, they may suddenly require feedback, interrupts, and numerous subroutines. Real world tasks are fundamentally different from those used in experimental GDSS research.

As we have seen before, one particular type of a GDSS may be more effective in dealing with one particular type of task rather than the others. Then, it is possible to integrate various types of GDSS softwares into the one toolkit according to their strengths to handle the particular type of task. Then, this toolkit can be used to help users to solve strategic problems which usually require managers to exercise all of the major types of decisional activities (e.g., problem finding, solutions development, and choice) together. Of course, it is theoretically possible to use the toolkit in cycling fashion responding to group needs. But in practice, it is almost impossible for participants to use the various tools in a relatively simultaneous manner to respond to their sudden needs of feedback, interrupts, and numerous subroutines in the decision process. Therefore, this toolkit approach may inevitably impose the fixed linear sequence of decisional activities on the group process. The imposed linear sequence of activities by the toolkit is contrary to the manager's needs that may require a great deal of cycling between phases. In fact, Isenberg (1984) found that senior managers often ignore the implied linear progression of the rational decision-making model and jump opportunistically from phase to phase, allowing implementation concerns to affect the problem definition and perhaps even to limit the range of solutions generated. Similarly, King (1985) addressed that many successful executives operate in an almost anti-decision mode by asking probing questions and raising issues to key organisational participants. Mittman and Moore (1984) also showed that executive decision making involves a brief, almost inconsequential problem-solving phase followed by a significant emphasis on decision implementation. Isenberg (1985), then, characterised the executive thought processes as highly inferential, intuitive, and opportunistic (small amounts of data combined with assumptions, experiences, and knowledge); interpersonal and organisational (individuals and networks of individuals are involved in the thinking process); and, intimately linked to action. Senior executive thought processes seem to be most likely vastly different from what is normatively viewed as a "rational decision making."

As Isenberg (1984) points out, one alternative to the vain task of trying to rationalise managers is to increase the rationality of organisational systems and processes. GDSSs are one source of organisational rationality. Here, we have opposing parts: the

thought process of a manager is almost intuitive and inconsequential, but the rational decision-making process in GDSSs implies a linear sequence of decisional activities. Huber (1983) points out that since individual predispositions are often dysfunctional in certain decision environments, designing a (G)DSS to support those predispositions could exacerbate the problem rather than improve the situation. On the other hand, providing a (G)DSS whose features do not support decision makers' cognitive styles would likely result in nonuse of the (G)DSS, or if use were mandatory, lower performance. In fact, Gibson & Ludl (1988) find out that the difference between the preferred decision-making process imposed by the system designer and that of some of senior level managers were important factors in the eventual demise of the Planning Lab at Execucom. It is, therefore, crucial for GDSSs to be flexible enough to maintain a balance between managers' needs and their imposed "rational" structure. Phillips (1988) also cautions that the GDSS should be adaptable to group needs; a strictly rule-based approach to a GDSS, or a fixed sequence of activities that are linearly driven by the facilitator, will inevitably fail in many situations.

#### **6.8.1. Task categorisation for the analysis of a GDSS effectiveness in real world settings**

The initial perception of the group with regard to their task at hand can strongly affect their cognitive activities during the decision making process. Poole (1981) argues that it is the members' perceptions of task requirements that guide the group's work. In fact, many researchers have called for more research into the initial phases of decision-making activity that have been named problem finding (Pounds, 1969), problem formulation (Lyles, 1981; Mintzberg et al., 1976), and issue diagnosis (Dutton et al., 1983).

Mintzberg et al. (1976) categorise decisions based on the initial stimulus that evokes them along a continuum as follows:

##### (1) Opportunity decisions

Those are initiated on a purely voluntary basis, to improve an already secure situation.

##### (2) Crisis decisions

Those are evoked when managers have to respond to intense pressures. Here, a severe situation demands immediate action.

##### (3) Problem decisions

Those fall in between the two ends of the continuum, evoked by milder pressures than crisis.

The initial decision stimulus has been found to affect the type and amount of decisional activity that occurs; the degree of the initial decision stimulus has been shown to have the greatest impact on the range of alternatives considered and the final choice (Lyles, 1981; Mintzberg et al., 1976). Similar study was carried out in GDSS environment. Chun (1988b) examined a selection of 12 cases of decision conferences conducted by DAU at L.S.E., which were in similar conditions (i.e., participants were from one organisation, used same software, and etc.) but differed in the degree of threat (or stimulus) expressed by the group in the discussion at the initial problem finding stage. Like the results of Mintzberg et al.'s (1976) above, it was found that even in GDSS environment, the degree of threat had a pronounced influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options.

In this section, we investigate the relationships between the degree of task stimulus brought in a DC and the participants' perceived effectiveness of the DC, especially with regard to decision quality which is measured by the number of options and criteria in evaluating those options.

The categorisation of DCs according to the degree of threat has been carried out based on the two methods: first, the DCs facilitated by Phillips and Hall were categorised by the author with referring to the section of background, key issues, missions, assumptions, constraints, and sometimes management summary in DC documents, and second, the DCs facilitated by Peterson were scaled by the facilitator himself. Because both methods were based on human judgements, the categorisation could be influenced by the subjective bias. Therefore, rather than categorising DCs in detail, I divide them as high and low threat ones. Examples of the categorisation are as follows:

(i) High threat task

- "Now something is radically wrong."

- Group expressed strong dissatisfaction with the current strategy.

(ii) Low threat task

- To secure for the Company a strong position in high-growth international markets and generate a consistently growing contribution to Group revenues and profits

- Our objectives are (1) one of the three world leaders in ..... market sector, (2) the No. 1 supplier of ..... in Europe, and (3) a recognised supplier of ..... in the world market.

## 6.8.2. Findings

### (1) Facilitator: Peterson

Table VI-38 below presents the results of 10 analyses of variance to test the differences in the perceived effectiveness of DCs according to the degree of threat expressed by the group in their discussion at the initial problem finding stage, under Peterson's facilitation.

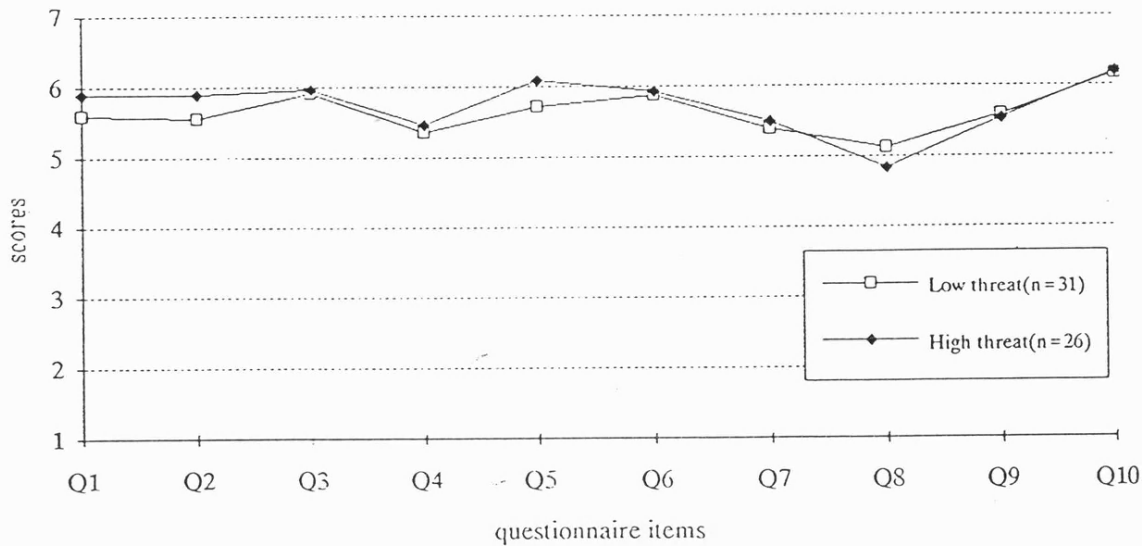
The results of statistical analysis (p-values) show that the perceived effectiveness of DCs is independent of the degree of threat, for all of the 10 evaluation criteria. Under Peterson's facilitation, there were very little differences in the perceived effectiveness of DCs between the high threat groups and the low threat ones.

**Table VI-38: Results of two sample T-test for measures of perceived DC effectiveness differences between high and low threat groups (individual score as a unit of analysis. WH+TV. Peterson. American managers. n=57)**

Criteria for measures of DC effectiveness	Low Threat (n=31)	High Threat (n=26)	P - value
Q1. Participatory Process	5.58	5.88	0.37
Q2. Data-based Process	5.55	5.89	0.28
Q3. Adaptable Process	5.90	5.96	0.85
Q4. Legitimacy of Decision	5.35	5.46	0.75
Q5. Efficiency of Decision	5.71	6.08	0.19
Q6. Goal-centred Process	5.87	5.92	0.84
Q7. Accountability of Decision	5.39	5.50	0.77
Q8. Supportability of Decision	5.13	4.85	0.47
Q9. Attitudes: Challenge and Accomplishment	5.58	5.54	0.89
Q10. Attitudes: Enhancement of Problem-solving Ability	6.16	6.19	0.88

Figure VI-31 below provides the visual representation of the values in table VI-38 above. It clearly shows little differences in the perceived effectiveness of DCs between the high threat groups and the low threat ones through the 10 criteria. It is interesting to note that the figure VI-31 shows the consistent tendency of the perceived effectiveness of DCs across the 10 criteria independent of the differences in the degree of threat group confronts;  $r_s$  in table VI-39 strongly supports this finding with statistical significance.

**Figure VI-31: Comparison of perceived DC effectiveness differences between high and low threat groups (individual score as a unit of analysis. WH+TV. Peterson. American managers. n=57)**



**Table VI-39: Correlation of the ranks of the scores on the 10 evaluation criteria (under Peterson's facilitation. WH+TV. American managers. two-tailed test)**

Correlation of Two Threats	$r_s$
Low threat (n=31) and High threat (n=26)	0.924****

$r_s$ : Spearman's rank correlation coefficient

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

## (2) Facilitator: Phillips

Table VI-40 below presents the results of 12 analyses of variance to test the differences in the perceived effectiveness of DCs according to the degree of threat expressed by the group in their initial discussion of the problem, under Phillips' facilitation.

Although the results of statistical analysis in table VI-40 represent that the perceived DC effectiveness of low threat groups with regard to Adaptable process (Q3) was statistically significantly better than that of high threat groups, they also show that

there were little differences in the perceived DC effectiveness between high threat groups and low threat ones with regard to 11 out of the 12 evaluation criteria.

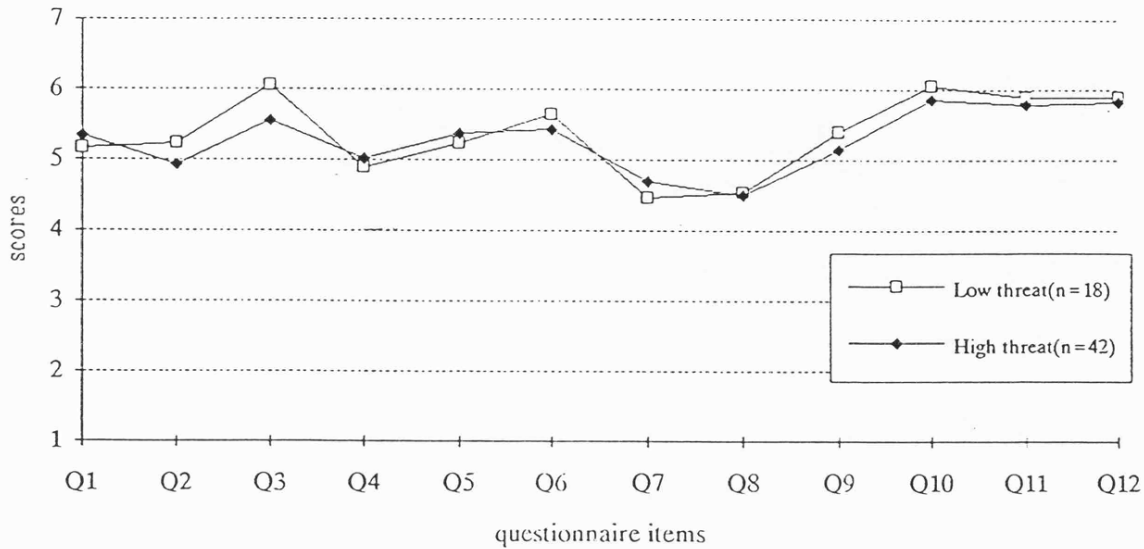
**Table VI-40: Results of two sample T-test for measures of perceived DC effectiveness differences between high and low threat groups (individual score as a unit of analysis. various co.+ ICL. Phillips. British managers. n = 60)**

Criteria for measures of DC effectiveness	Low Threat (n = 18)	High Threat (n = 42)	P - value
Q1. Participatory Process	5.17	5.33	0.59
Q2. Data-based Process	5.22	4.93	0.38
Q3. Adaptable Process	6.06	5.55	0.052*
Q4. Legitimacy of Decision	4.88	5.02	0.68
Q5. Efficiency of Decision	5.22	5.38	0.69
Q6. Goal-centred Process	5.65	5.43	0.50
Q7. Accountability of Decision	4.47	4.69	0.54
Q8. Supportability of Decision	4.53	4.50	0.92
Q9. Attitudes: Challenge and Accomplishment	5.39	5.14	0.43
Q10. Attitudes: Enhancement of Problem-solving Ability	6.06	5.86	0.50
Q11. Decision Quality: # of alternatives generated	5.89	5.79	0.66
Q12. Decision Quality: # of criteria considered	5.89	5.81	0.75

\* : statistically significant to reject null hypothesis with 90% credibility

Figure VI-32 below presents graphically the mean scores in table VI-40. It clearly shows very little differences in the perceived effectiveness of DCs between the two groups with regard to most of the 12 evaluation criteria. Like the Peterson's, figure VI-32 also shows the consistent pattern of perceived effectiveness of DCs for the 12 evaluation criteria irrespective of the degree of threat group confronts;  $r_s$  in table VI-41 supports this finding with statistical significance.

**Figure VI-32: Comparison of perceived DC effectiveness differences between high and low threat groups (individual score as a unit of analysis. various co.+ICL. Phillips. British managers. n=60)**



**Table VI-41: Correlation of the ranks of the scores on the 12 evaluation criteria (under Phillips' facilitation. various co.+ICL. British managers. two-tailed test)**

Correlation of Two Threats	$r_s$
Low threat (n=18) and High threat (n=42)	0.900****

$r_s$ : Spearman's rank correlation coefficient

\*\*\*\*: reject the null hypothesis that there is no association between the rank pairs with 99% significance

As we mentioned earlier, it was found that in DC environment, the degree of threat had a pronounced influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options [Chun, 1988b]. Using a new set of data, table VI-42 below confirms this finding. Table VI-42 shows that under Phillips' facilitation, low threat groups developed more options and evaluated those options with more criteria in tackling resource allocation problems using EQUITY programmes. Now, we have two seemingly inconsistent findings. First, the degree of threat had a pronounced influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options (see average in table



VI-42). Second, there is almost no differences in the perceived DC effectiveness with regard to Decision quality ( the number of alternatives and criteria generated) between high threat groups and low threat ones (see Q11, and Q12 in fig. VI-32). In other words, high threat groups perceived the capability of DC in generating alternatives and criteria quite equally high to those in low threat situations, even though they actually produced fewer options and considered fewer criteria in evaluating those options than did low threat groups.

**Table VI-42: Relationships between the degree of threat and the number of options and criteria generated in the DC under Phillips' facilitation**

Software: EQUITY					
Date	Organisation Name	# of criteria	# of options/pot	# of pot	Degree of threat
(AK) June 28-29 '88	Yorkshire Regional Health Autho.	2	3.1	8	High
(AM) Jan. 11-12 '89	Hunter Saphir (SWOT analysis done)	4	4.4	8	High
(AO) May 8-9 '89	IBM (UK)	2	2.8	8	High
(AS) Oct. 10-11 '89	ICL - UK Divisions	4	4.9	9	High
(AQ) June 9-10 '87	ICL - Division & Group Information Services	2	4.1	13	High
(AR) Sept. 21-22 '87	ICL - Marketing of DC	2	4.3	8	Low
(AL) Nov. 22-23 '88	Deloitte Haskins & Sells Mgmt Consultancy Div.	5	5	9	Low
(AP) Mar. 25-26 '87	ICL - Public Services Business	7	5.3	7	Low
<b>Average:</b>	<b>High Threat</b>	<b>2.80</b>	<b>3.86</b>	<b>9.20</b>	
	<b>Low Threat</b>	<b>4.70</b>	<b>4.90</b>	<b>8.00</b>	

A possible interpretation of the findings might be that participants with both types of tasks (high and low threat) viewed the aid of a DC in generating alternatives and criteria was much better than the conventional meeting with the associated levels of task threat. Low threat groups thought that, compared to conventional meeting with low threat task , they produced more alternatives and criteria due to the aid of DC. Similarly, high threat managers perceived that they also evaluated more alternatives with more criteria under the support of a DC, compared to the conventional meeting with the associated levels of task threat. In both circumstances (high threat as well as low threat), managers thought that without the aid of a DC, they would have produced less number of alternatives and considered fewer criteria in evaluating those alternatives.

### (3) Facilitator: Hall

All of the five sample DCs facilitated by Hall were categorised as low threat ones. So, no analysis has been carried out.

### 6.8.3. Summary

(1) Considering the results of statistical analysis (table VI-38, and-40) and graphical representation of the mean values (fig. VI-31, and -32) together, we may conclude that there was very little differences in the perceived effectiveness of DCs between the high threat groups and low threat ones across the 12 (in case of Peterson, 10) evaluation criteria. This finding together with previous ones might indicate that compared to a conventional meeting, the use of a DC can have same positive effects on the meeting outcomes when dealing with high threat tasks as well as low threat ones.

(2) Previous studies (Lyles, 1981; Mintzberg et al., 1976) have found that the initial decision stimulus affects the type and amount of decisional activity that occurs; the degree of the initial decision stimulus has been shown to have the greatest impact on the range of alternatives considered and the final choice. Similarly, it was found that in a DC environment, the degree of threat had a pronounced influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options (Chun, 1988b). Present study with using a new set of data confirms the previous finding.

(3) High threat groups perceived the aid of a DC in generating alternatives and criteria quite equally high to those in low threat situations, even though they actually produced fewer options and considered fewer criteria in evaluating those options than did low threat groups. A possible interpretation of the findings might be that participants in both situations (high as well as low threat) viewed the aid of a DC in generating alternatives and criteria was much better than the conventional meeting with the associated levels of task threat.

(4) Table VI-39, -41 above summarise the correlation ( $r_s$ ) between the two groups of rankings of the scores on the 12 criteria (in case of Peterson, 10), based on the differences in the degree of task threat group confronts. They altogether indicate that the perceived effectiveness of DCs across 12 (or 10) criteria shows consistent patterns independent of the differences in the degree of task threat.

## 6.9. Conference as a Whole

In this section, I examine the two DCs in each facilitator: the one which was perceived to be a more successful one, and the other which was rated to be a less successful one. Then, I try to figure out what differences these two DCs have each other.

### 6.9.1. Facilitator: Peterson

For each of the 5 DCs selected, 10 question scores were generated to measure participants' perception of the effectiveness of DCs. Individual scores on each question (criterion) were averaged in each DC to prepare for subsequent analyses.

From these measures of the 10 criteria, the differences in the perception measures between the DCs emerged.

Remember that Peterson had chosen the sample DCs by himself, which he had thought to be successfully performed. In spite of the careful selection, figure VI-33 below shows the clear differences in the effectiveness measures of DCs for the 10 criteria between the DCs which were perceived by the participants as a more successful one and a less successful one, under Peterson's facilitation.

**Figure VI-33: Comparison between the two DCs which had been perceived by the participants as a more successful one and a less successful one, under Peterson's facilitation (conference as a unit of analysis)**

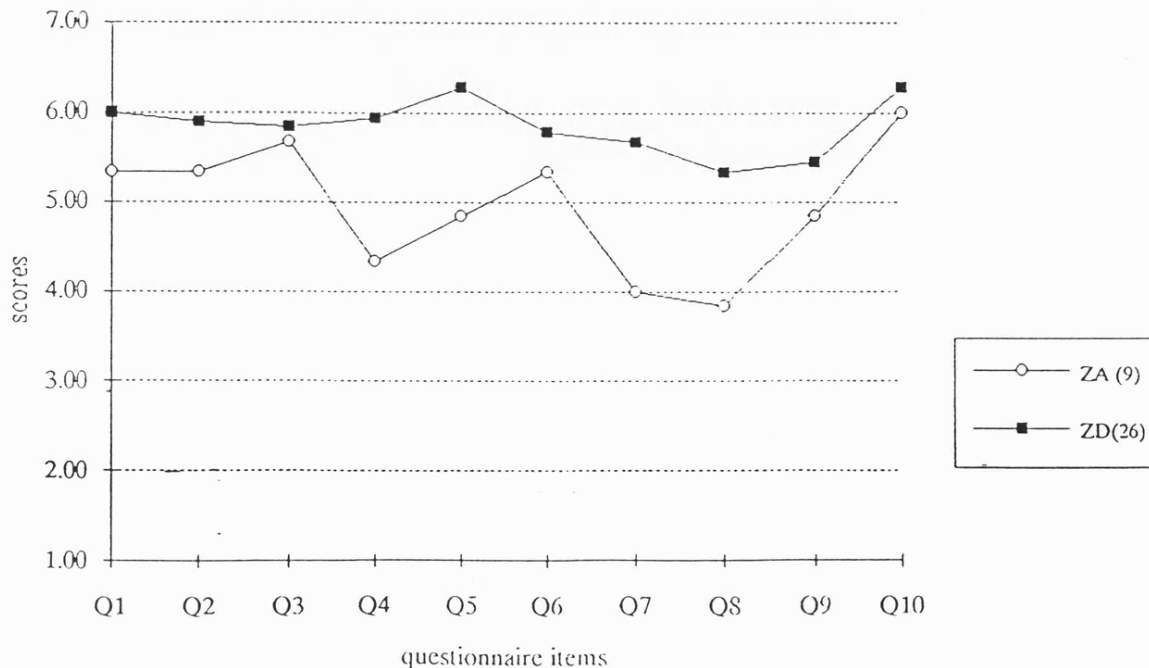


Table VI-43 below compares the "components" of two DCs. They were different from each other in terms of the industry engaged, group size, degree of task stimulus, and respondents' careers. In previous sections, we saw that the effect of organisation differences and degree of task threat on the participants' perception of the effectiveness of DCs was not significant. Also, under Peterson's facilitation, there were very little differences in the perceived effectiveness of DCs between marketing or sales, engineering, general administration, and personnel managers. But, broadcasting (TV news) people rated the effectiveness of DCs lower than did marketing or sales, and engineering people. We also found that large groups (size: 26, 30) perceived the effectiveness of DCs higher than did medium ones (size: 9, 11, 13).

**Table VI-43: Comparison between the DCs which had been perceived as a more successful one and a less successful one, under Peterson's facilitation**

	More successful DC	Less successful DC
Company	ZD (TV)	ZA (electronic manufacturing)
Group size	26	9
# of respondents	18 (18/26=69%)	6 (6/9=67%)
# of DCs a participant had attended	Ave: 2.4	Ave: 2
Careers	marketing or sales:7, engineering:2 general administration:2 broadcasting:3, others:4	marketing or sales:2, finance:1 general administration:3
Task threat	Low	High

Considering the several findings in previous sections and the present one together, we may cautiously conclude that under Peterson's facilitation, we can not rule out the existence of the group size-associated effect on the perception of the effectiveness of DCs: large groups appreciated the aid of a DC higher than did medium ones, especially with regard to Legitimacy of decision (=decision acceptance Q4), Efficiency of decision (Q5), and Supportability of decision (=implementation Q8).

### 6.9.2. Facilitator: Phillips

For each of the 11 DCs selected, 12 question scores were generated to measure participants' perception of the effectiveness of DCs. Individual scores on each question (criterion) were averaged in each DC to prepare for subsequent analyses. From these measures of the 12 criteria, the differences in the perception measures between the DCs emerged.

Figure VI-34 below shows the clear differences in the effectiveness measures of DCs for the 12 criteria between the DCs which were perceived by the participants as a more successful one and a less successful one, under Peterson's facilitation.

**Figure VI-34: Comparison between the two DCs which had been perceived by the participants as a more successful one and a less successful one, under Phillips' facilitation (conference as a unit of analysis)**

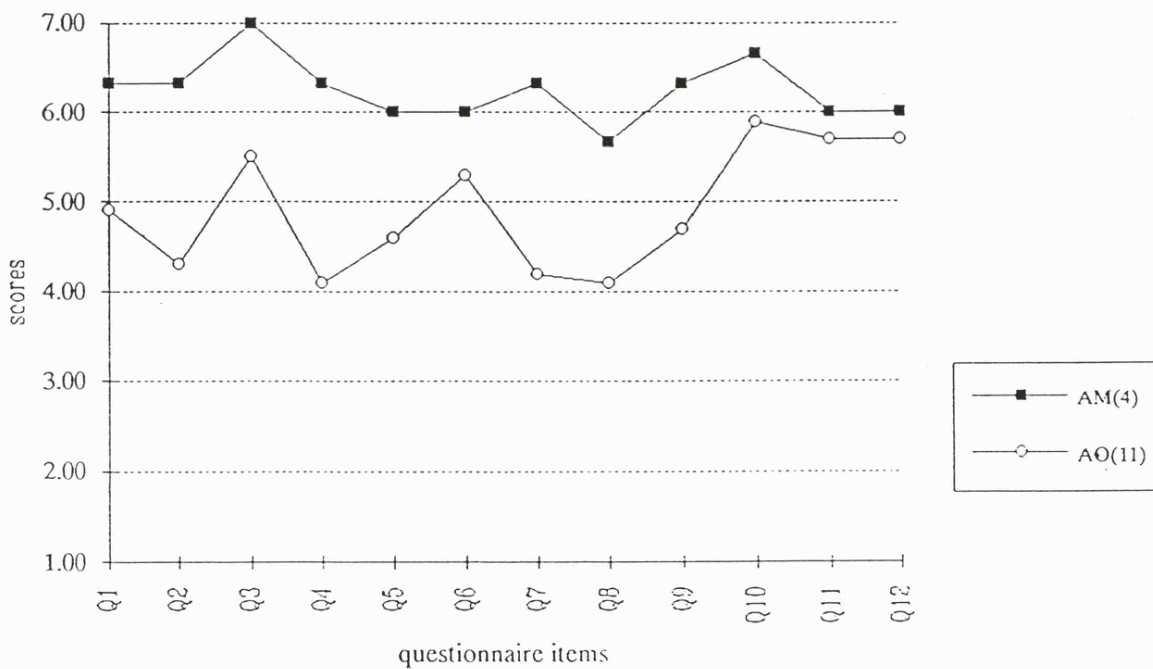


Table VI-44 below compares the "components" of two DCs. Two DCs were different from each other in terms of the industry engaged, group size, and participants' levels in the organisation. In previous sections, we saw that under Phillips' facilitation, the effect of organisation differences on the participants' perception of the effectiveness of DCs was nonsignificant. We also found that small groups (size: 4, 6, 8) perceived the effectiveness of DCs higher than did medium ones (size: 9, 11). The perceived effectiveness of DCs also became greater at higher levels in the executive hierarchy.

**Table VI-44: Comparison between the DCs which had been perceived as a more successful one and a less successful one, under Phillips' facilitation**

	More successful DC	Less successful DC
Company	AM (food manufacturing)	AO (computer manufacturing)
Group size	4	11
# of respondents	3 (3/4=75%)	10 (10/11=91%)
Stratum	Ave: 6 (V:1, VI:1, VII:1)	Ave: 3.5 (III:5, IV:5)
# of DCs a participant had attended	Ave: 1	Ave: 1
Careers	marketing or sales:2, finance:1	marketing or sales:8, finance:1 general administration: 1
Task threat	High	High

Considering the findings in previous sections and the present one together, we may carefully conclude that under Phillips' facilitation, the existence of the group size-, and stratum difference-associated effect on the perception of the effectiveness of DCs can not be ruled out: small groups appreciated the aid of a DC higher than did medium ones, especially with regard to Legitimacy of decision (=decision acceptance Q4), Accountability of decision (Q7), and Supportability of decision (=implementation Q8). Compared to the managers in strata II-III and IV-V, strata VI-VII executives perceived the aid of a DC significantly effective with regard to Attitudes (challenge and accomplishment Q9), Adaptable process (Q3), Attitudes (enhancement of problem-solving ability Q10), and Accountability of decision (Q7).

### 6.9.3. Facilitator: Hall

For each of the 5 DCs selected, 12 question scores were generated to measure participants' perception of the effectiveness of DCs. Individual scores on each question (criterion) were averaged in each DC to prepare for subsequent analyses. From these measures of the 12 criteria, the differences in the perception measures between the DCs emerged.

Figure VI-35 below shows the clear differences in the effectiveness measures of DCs for the 12 criteria between the DCs which were perceived by the participants to be a more successful one and a less successful one, under Hall's facilitation.

**Figure VI-35: Comparison between the DCs which had been perceived by the participants as a more successful one and a less successful one, under Hall's facilitation (conference as a unit of analysis)**

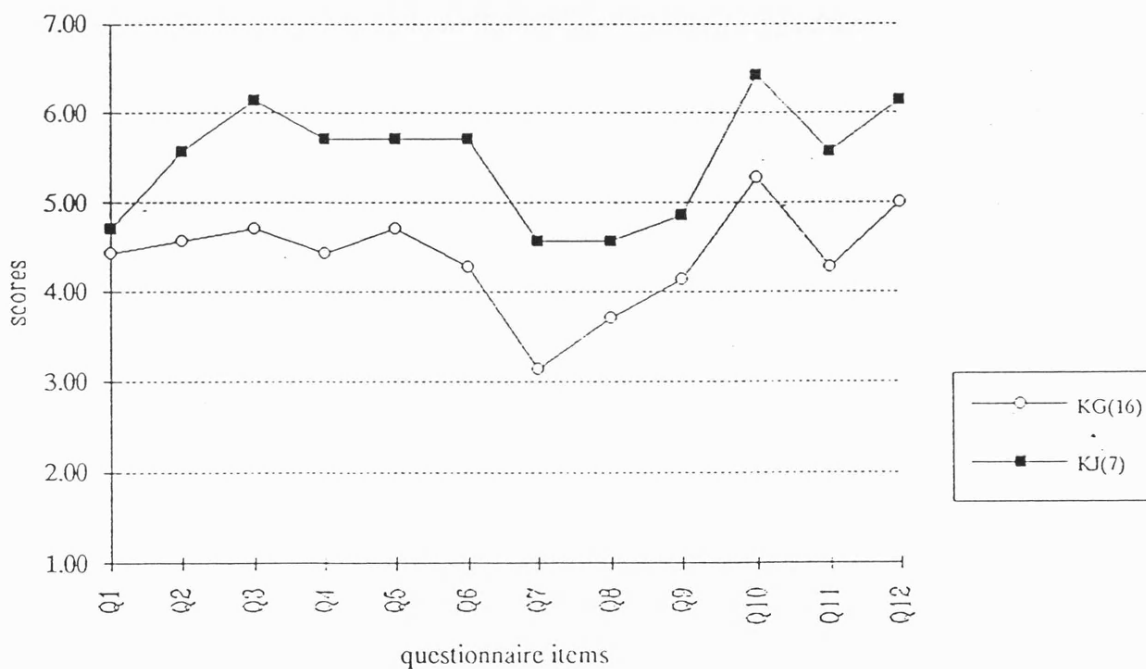


Table VI-45 below compares the "components" of two DCs. Two DCs were different from each other in terms of the group size and their careers. In previous sections, we saw that Hall's facilitation was perceived convincingly more effective in aiding medium groups (size: 9, 10, 11) rather than large ones (size 16, 19). We also saw that the R & D managers' perceptions of the effectiveness of DCs were significantly lower than those of marketing or sales, and engineering managers.

**Table VI-45: Comparison between the DCs which had been perceived as a more successful one and a less successful one, under Hall's facilitation**

	More successful DC	Less successful DC
Company	KJ (ICL)	KG (ICL)
Group size	10	16
# of respondents	7 (7/10=70%)	7 (7/16=44%)
Stratum	Ave: 3.7 (III:2, IV:5)	Ave: 2.9 (II:1, III:4, IV:1)
# of DCs a participant had attended	Ave: 2	Ave: 1.4
Careers	marketing or sales:5, finance:2	engineering:2, R & D:5
Task threat	Low	Low

Considering the findings in previous sections and the present one together, under Hall's facilitation, we can not rule out the existence of the group size-, and career difference-associated effect on the perception of the effectiveness of DCs: medium groups rated the aid of a DC significantly higher than did large ones for most of the 12 evaluation criteria. R & D managers perceived the effectiveness of DCs discernibly lower than did marketing or sales managers.



## CHAPTER 7. SUMMARY AND CONCLUSION

### 7.1 Summary

#### 7.1.1. Introduction

The effectiveness of one type of group decision support systems (here, Decision Conferencing) was evaluated by examining groups using the Decision Conferencing Inc. (DCI) in the U.S.A., and Decision Analysis Unit (DAU) at the London School of Economics (LSE) and Decision Conferencing Unit (DCU) at the International Computers Ltd. (ICL) in the U.K. Decision Conferencings (DCs) are now actively operated at several universities and companies in the UK, USA, and Australia.

The primary purpose of the research was to investigate the effectiveness of a DC in aiding group decisional activities with regard to decision processes, overall attitudes, and decision quality, based on conference participants' self-report of their perceptions, and to identify variables associated with differences in perceived effectiveness.

Quantitative data were collected through a self-administered mailed survey of participants in 22 conferences. In the fall of 1989 and early 1990, questionnaires were sent to all participants in 22 conferences for whom addresses remained available. Of the 245 questionnaires which were distributed, 142 were replied, resulting in a response rate of 58%. Respondents ranged in managerial experience from 7 to 46 years with average 24 years, in current organisation tenure from 6 months to 38 years with average 13 years, and in current job tenure from 3 months to 14 years with average 3 years.

Based on the Competing Values Approach (CVA) to organisational analysis, 8 items, one for each criterion associated with the CVA framework were designed to measure decision process effectiveness of a DC compared to a conventional meeting: a particular decision process was judged by the nature of the process itself (i.e., Q1: participatory process, Q2: data-based process, Q3: adaptable process, and Q6: goal-centered process) and the type of decision associated with that type of process (i.e., Q8: supportability of decision, Q7: accountability of decision, Q4: legitimacy of decision, and Q5: efficiency of decision). These 8 criteria offered explicit standards against which to judge the effectiveness of group decision processes. Other four scales

were included to measure the effectiveness of a DC in terms of attitudes toward a DC overall (i.e., Q9: challenge and accomplishment, and Q10: enhancement of problem-solving ability), and decision quality (i.e., Q11: the number of alternatives generated, and Q12: the number of criteria considered).

A number of variables were hypothesised to influence the level of perception of the effectiveness of a DC:

- (1) the variety of facilitators,
- (2) organisation differences,
- (3) individual participant differences in terms of (i) different strata in their organisations, (ii) different work experience (the main functional area of business in his whole working careers), and (iii) the amount of prior experiences with DCs,
- (4) group size, and
- (5) the task differences in terms of the degree of threat.

*Overall, the intervention of a DC was perceived better than a conventional meeting for all of the 12 criteria to measure its effectiveness in terms of decision processes, overall attitudes toward the system, and decision qualities.*

It is, however, worthwhile to note that a DC can produce the very different profiles of conference effectiveness according to some of the variables mentioned above.

### **7.1.2. Facilitators, participants' careers, and organisation differences**

Facilitators in DCs not only select what software to be used but also direct the process of the meeting. More importantly, they provide the flexibility that is needed to represent the different aspects of the problem with different structures. Because they are human beings, facilitators can have naturally their own "philosophy" about how to facilitate a DC (in other words, what a good decision-making process should be). For example, while one facilitator believes the implementation stage to be more important than the others, the other facilitator considers the evaluation stage to be the most important one. Furthermore, some facilitators prefer to impose more rigid structure to the process (a fixed sequence of activities), or to direct the process in maximum their control; whereas, others prefer to let group members decide what they want to do, and to guide the process in minimum their control. So, it might be intuitively right to expect that the results of a DC are partly influenced by the variety of facilitators.

Overall, p-values show that Peterson dominated other two facilitators with regard to most of the 10 criteria of measuring the effectiveness of a DC in aiding group collaborative work. However, there were limitations in Peterson's data to generalise this finding. In case of Phillips and Hall, the sample DCs were selected randomly by the investigator, whereas the sample conferences of Peterson were chosen by the facilitator himself. He chose samples which he felt to be better performed. So, Peterson's scores may reflect the mean of more successful DCs, whereas Phillips and Hall's reflect the mean of generally executed DCs. The other possible limitation is that the respondents of Peterson were American managers, whereas those of Phillips and Hall were mostly British managers. Thus, the results might reflect national differences as well.

Independent of organisation differences, the results of statistical analysis show that participants rated Phillips' facilitation discernibly higher than Hall's across at least three criteria: Participatory process (Q1), Attitudes expressed by the degree of challenge and accomplishment (Q9), and Decision quality in terms of the number of alternatives generated (Q11). P-values also show that Phillips' facilitation was perceived moderately better than Hall's with regard to Adaptable process (Q3), Goal-centred process (Q6), and Accountability of decision (Q7). But, raw data show that Phillips' facilitation was perceived better than Hall's with respect to 10 out of the 12 evaluation criteria. Hall's facilitation was rated slightly higher than Phillips' in only 2 criteria: Data-based process (Q2), and Legitimacy of decision (= decision acceptance Q4).

Now, we test the verification of these findings using more controlled data: responses of marketing or sales managers only. Although raw data show that marketing or sales managers perceived Peterson's facilitation better than the other two facilitators' for all of the 10 criteria, p-values reveal that Peterson's facilitation was perceived discernibly better than Phillips' in only 2 criteria: Data-based process (Q2), and Efficiency of decision (Q5), and it was also perceived discernibly better than Hall's with regard to only 4 criteria: Data-based process (Q2), Adaptable process (Q3), Goal-centred process (Q6), and Attitudes (challenge and accomplishment Q9). But, remember that using the scores obtained from the managers in all of the 10 business areas, we previously saw that Peterson's facilitation was perceived with statistical significance better than the other two facilitators' with regard to 9 out of the 10 evaluation criteria.

P-values also show that marketing or sales managers perceived Phillips' facilitation discernibly better than Hall's in only 1 criteria: Attitudes in terms of challenge and accomplishment (Q9). Raw data also show that there were no distinctive differences in the effectiveness measures of DCs between the marketing or sales managers under Phillips' facilitation and those under Hall's facilitation; Phillips' facilitation was rated better than Hall's with regard to Participatory process (Q1), Adaptable process (Q3), and Attitudes (challenge and accomplishment Q9), whereas Hall's facilitation was perceived better than Phillips' with respect to Data-based process (Q2), Legitimacy of decision (Q4), and Efficiency of decision (Q5). Both facilitations were all much the same in the scores with regard to the rest of the criteria (Q6, Q7, Q8, Q10, Q11, and Q12).

The results show that *facilitator-associated effect on the differences in the marketing or sales managers' perception of the effectiveness of DCs was much less than that of the managers in all of the 10 business areas*. In particular, there were almost no dominations in the perception of the effectiveness of DCs between the marketing or sales managers under Phillips' facilitation and those under Hall's facilitation. In fact, the relative low scores in Hall's facilitation from the managers in all of the 10 business areas were mainly attributable to the R & D managers' particularly low perception of the effectiveness of DCs compared to the managers in other careers.

Therefore, the conclusion we can make here is that although the existence of a facilitator-associated effect on participants' perception of the effectiveness of DCs can not be ruled out, it is not a strong variable to determine the level of the perception. Its effect emerged when it was compounded with other variables. For example, compared to the managers in other organisations, ICL managers perceived that Phillips' facilitation was particularly effective with regard to Participatory process (Q1). *Whereas managers in other organisations regarded the empirical perspective to be more important than other three decision-making perspectives, ICL managers thought that the consensual perspective was the most important one*. So, Phillips' consensus-oriented facilitation method might be appreciated more positively by ICL managers than by the managers in other organisations. This finding fully compliments Churchill's (1990) argument that the differences in the culture and style of the organisation are important for the decision support facilitator for it will influence how he or she approaches the decision event and will determine the skills he or she will need and the methods he or she will use. It also would mean that GDSS developers should consider such organisational and behavioural attributes in designing the system. As Huber (1981) pointed out, this consideration may require the system design to move more toward "demand-pull" and

away from the more traditionally dominant "supply-push" bias of technology development. However, *despite the differences in terms of business fields, and organisational cultures, managers from different industries measured the effectiveness of a DC quite closely each other for most of the evaluation criteria (but, not all of them), if they were hosted by the same facilitator.*

### **7.1.3. Different strata**

Theory (Jaques, 1989) argues that the characteristics of the task demands become more abstract and conceptual as one progresses up the executive hierarchy; in particular, there is a big shift from operation management (stratum II-III) domain to general management (stratum IV-V) one, and even bigger shift from general management to corporate strategic (stratum VI-VII) one in terms of the degree of abstraction of the task requirement managers find themselves with. So, it may be right to assume that, different from lower stratum managers, higher level executives may desire to see their more "invisible" (abstract and conceptual) problems with their eyes. This assumption is supported by previous studies (Wooler, 1987; Chun 1988a), both of which found that senior executives (stratum VI) twice as frequently restructure a model once they have seen the initial results than do general managers (stratum IV). Because their problems are more "invisible" (abstract), I think, senior executives frequently restructure the model than do lower stratum managers. During their restructuring process, senior executives gradually put their abstract and conceptual ideas into the visible form. Therefore, we can assume that senior managers may appreciate the effectiveness of a DC higher than do lower stratum managers; in other words, the perceived effectiveness of DCs would be greater at higher levels in the organisational hierarchy.

Present study supports this assumption empirically; *the perceived effectiveness of DCs was greater at higher levels in the executive hierarchy. The differences in the perceived effectiveness of DCs between stratum VI-VII (corporate strategic) and IV-V (general management) managers were bigger than those between stratum IV-V and II-III (operation management) managers. Present study shows that managers in different levels perceive the effectiveness of a GDSS differently.*

Unlike theoretical arguments, however, strata II-III and IV-V managers showed almost no differences in their ideal decision-making perspectives. Furthermore, contrary to the theoretical articulations, managers in strata II-III and IV-V rated the consensual perspective to be more important than the empirical or rational

perspective. But, as expected, they considered the political perspective to be the least important one among four perspectives. However, executives at strata VI-VII rated the political perspective to be the most important one, then consensual, empirical, and considered the rational perspective to be the least important one among four perspectives. This finding is consistent with the theoretical articulations. Of greater interest is the finding that *unlike other perspectives, the importance of political perspective in decision-making takes a sharp leap when managers move into stratum VI*.

#### 7.1.4. Group size

Proponents of a multi workstation GDSS have pointed out that use of GDSS technology has some overhead cost; this overhead cost (or "process loss") may simply have been higher than the marginal benefits provided to small group addressing less complex tasks (Dennis et al., 1988; Gallupe et al., 1988). In fact, much multi workstation-based GDSS research has continuously reported that for small groups (size up to 6-8), computer-aided support is not more effective or efficient than an unstructured face-to-face meeting, due to the overhead cost introduced by the specific GDSS technology (Dennis et al., 1988; Gallupe et al., 1988). Unlike the multi workstation-based GDSS, a DC is a single workstation-based GDSS. It means participants in DCs do not need to directly interact with the computers by themselves. So, we can expect that compared to the users of a multi workstation-based GDSS, technical intrusion problem should be of little importance to the users of a single workstation-based GDSS. In other words, overhead costs of a single workstation-based GDSS would be much less than those of a multi workstation-based GDSS. If so, we can assume that even for small groups, the support of a single workstation-based system (here, DC) could be more effective or efficient than an unstructured face-to-face meeting. The result of present study supports this assumption well: *under Phillips' facilitation, the perceived effectiveness of DCs of small (size 4, 6, 8) groups was higher than that of medium (9, 11) or large (15, 18) ones*.

Multi workstation GDSS researchers have also continuously claimed that efficiency and effectiveness consideration of the multi workstation GDSS become increasingly apparent as group size increases; the meeting productivity, and the effectiveness and efficiency of the equal participation can be remarkably enhanced due to parallel processing approach of electronic communication channel (Nunamaker et al., 1989; Vogel et al., 1987; Vógel & Nunamaker, 1990). They, then, assert that resorting to a single workstation for large groups simply does not work. If their assertions are

correct, the support of a single workstation-based system (here, a DC) should become less effective or especially less efficient, as groups become larger.

*The results of present study show that the relationship between group size and perceived effectiveness of DCs differs each other according to facilitators. For example, under Peterson's facilitation, the perceived effectiveness of DCs of large (size 26, 30) groups was higher than that of medium (size 9, 11, 13) ones. Hall's facilitation, however, was perceived convincingly more effective in aiding medium (size 9, 10, 11) groups rather than large (size 16, 19) ones. Under Phillips' facilitation, the perceived effectiveness of DCs of small (size 4, 6, 8) groups was higher than that of medium (size 9, 11) or large (size 15, 18) ones. But, larger groups perceived the effectiveness of DCs higher than did medium ones.*

This result may tell us that when properly facilitated, a single workstation-based GDSS (here, a DC) could be used successfully to aid the collaborative work of large groups (size 15 or more). *Of greater interest to note, however, is the finding that so contrary to the anticipation of multi workstation-based GDSS researchers, large groups rated the effectiveness of DCs discernibly higher than did medium or small groups with regard to Efficiency of decision (Q5) and even Participatory process (Q1), under Peterson's as well as Phillips' facilitation.* The primary rationale for the heavy investments in multi workstation-based GDSSs is to enhance the efficiency of the equal participation of large groups through the parallel processing approach of an electronic communication channel. Present study shows that efficiency and participation consideration of large groups can also be achieved by manually facilitated methods, not necessarily only by an electronic communication channel.

*Independent of numerous variables mentioned earlier, a DC was perceived relatively less effective with regard to Accountability of decision (Q7) and Supportability of decision (Q8), compared to other evaluation criteria. Ackoff (1981) asserts that it is important for those charged with implementing a decision to understand why the decision was made. The best way to do this is to include as many of these people as possible in the group (Dennis et al., 1988). Therefore, it is generally assumed that because larger groups usually include more stake holders in their problem-solving process, the meeting outcome could be supported by more people, thus it would have more chance to be implemented. The empirical results of this study, however, indicate that this assumption about the positive relationship between group size and implementation of the decision may be premature.*

Using the decision theorist's definition of a decision (an irrevocable commitment of a resource), Phillips (1991) argues that only individuals take decisions, for only individuals can be held accountable for the consequences of using the resource. Groups do not take decisions. Even if a decision is delegated to a group, it is the manager who finally takes it, for in addition to having the power to veto it, only the manager is authorised to commit the resource. The decision-making process in DCs generally involves a manager, his peers, and subordinates together, and encourages lateral communication among them to obtain collective agreement to a decision. As Phillips (1991) points out, this process may contradict the decision taker's accountability. Therefore, *a DC was perceived relatively less effective with regard to Accountability of decision (Q7). Therefore, implementation of decisions (=Supportability of decision Q8) can be hardly improved.*

Phillips' articulation above (and, the present empirical results support his view) raises a question to the current trend in multi workstation-based GDSSs research, where more equal participation of the members is encouraged through anonymous messaging function by way of the electronic communication channel, which inevitably ignores participants' differences in terms of their roles, strata, power and etc. If so, it is likely that decision taker's authority and leadership can be more damaged in multi workstation-based GDSS environments.

No GDSS research so far has been found to investigate its effect on the improvement of implementation of a decision. Future GDSS research should address this important issues more carefully. Because, even if a decision-making aids produces higher quality outcomes, this is useless if implementation does not follow. In the meantime, *present study shows that although it was at least perceived slightly better than a conventional meeting, a DC was perceived relatively less effective with regard to Accountability of decision (Q7) and Supportability of decision (=implementation Q8), compared to other evaluation criteria.*

#### **7.1.5. Prior experience with a GDSS**

GDSS research has continuously reported that some learning periods through repeated use of the GDSS is required before achieving improved performance and satisfaction, if the system requires users to access the system by themselves, irrespective of whether it is a user-, chauffeur-, or facilitator-driven GDSS. The amount of required learning is problematic for GDSSs to be adopted by real world managers. Based on their painful experience of the demise of Planning Lab, Wagner



and Nagasundaram (1988) argue that if much learning is required in order to effectively use the system, it is not likely to succeed. They assert that the system needs to be a servant of management. Unlike the results from the study of a user-access type GDSS, *the present study shows that there were little differences in the perceived effectiveness of DCs (an analyst-access type GDSS) between the managers who had attended up to 4 DCs.* Therefore, the generalisation of the problems of technical unfamiliarity found in the initial use of user-access type GDSSs, can not be applied to user-free type GDSSs.

#### **7.1.6. Participants' main careers**

The sample sizes were not big enough to allow us to analyse the effect of all of the participants' careers on their perception of the effectiveness of DCs. So, the test has been carried out only for careers with more than five respondents. Therefore, the interpretation of the findings in this section was restricted by this limitation.

Under Peterson's facilitation, there was very little difference in the perceived effectiveness of DCs for most of the 10 evaluation criteria between the managers from marketing or sales, engineering, general administration, and personnel background. Similarly, under Phillips' facilitation, there was very little difference in the perception of the effectiveness of DCs for most of the 12 evaluation criteria between the managers from marketing or sales, finance, general administration, and education and consulting background.

Under Hall's facilitation, however, the perceived effectiveness of DCs of the ICL managers at strata III-IV with marketing or sales background was clearly higher than that of the identical managers with R & D background. The career-associated differences were also found in one of the Peterson's DCs. The perceived effectiveness of DCs of broadcasting (TV news) managers were lower than those of marketing or sales, and engineering managers for all of the 10 evaluation criteria. Although these findings show the existence of career-associated differences in the perception of the effectiveness of a DC, I must stress that further study would be needed to explore the career-associated effect on the perception in light of such a small sample sizes used in this study. In the mean time, *present pilot findings show that a career effect on the perception of the effectiveness of a DC can not be ruled out.*

### 7.1.7. Task differences

GDSS researchers have attempted to investigate the effect of tasks on how computer support is viewed and used. On the one hand, some GDSS researchers (Bui & Sivasankaran, 1990; Dennis et al., 1988; Gallupe, 1986; Gallupe et al., 1988; Gallupe & McKeen, 1990) have examined the effect of GDSS use on the meeting outcomes with varying the degree of task difficulty. All of the GDSS researchers above have found that use of GDSS has more positive effects on the meeting outcomes when dealing with more difficult tasks compared to less difficult ones. On the other hand, researchers mainly from the University of Minnesota have investigated the effect of GDSS use on the group performance with varying the extent and type of a particular activity inherent in each phase in decision-making process (e.g., problem finding, choice, consensus reaching, and etc.). This is based on the assumption that decision making involves a number of distinct phases (such as problem finding, solution generation, and choice)- that at any one point in the decision process, a particular type of decisional activity dominates all the others (Lyles, 1981; Mintzberg et al., 1976; Pounds, 1969). GDSS has been reported to have positive effect on the meeting outcome over manual or no support method in dealing with the problem finding task (Gallupe et al., 1988), idea generation task (Lewis, 1982), and choice task (Zigurs et al., 1988), but it has been found to show little performance advantage over manual structured support in tackling preference reconciliation (resolving conflicts and obtaining consensus) task (Beauclair, 1987; Gallupe, 1990; Gallupe & McKeen, 1990).

These results show that one particular type of GDSSs may be more effective in dealing with one particular type of tasks rather than the other. So, some GDSSs (e.g., Plexsys at the University of Arizona) integrate various types of GDSS softwares into the one "toolkit" according to their strengths to handle the particular type of task. Then, this toolkit can be used to help users to handle strategic problems which usually require managers to exercise all of the major types of decisional activities (e.g., information gathering, alternatives development, alternative evaluation, and alternative selection) together.

One of the possible pitfalls in this approach, however, may be that it inevitably imposes the fixed linear sequence of decisional activities on the group process, which is contrary to group needs. As even phase theorists have pointed out, decision-making process is not simple or orderly. Many researchers report that executive decision making often ignores the implied linear progression of the rational decision-making model. They describe a process involving feedback cycles, interrupts, and numerous

subroutines. So, we have opposing elements: the thought process of a senior managers is almost intuitive and inconsequential, but the rational decision-making process in GDSSs implies a linear sequence of decisional activities. It is, therefore, crucial for GDSSs to be flexible enough to maintain a balance between managers' needs and their imposed "rational" structure. Phillips (1988) argues that the GDSS should be adaptable to group needs; a strictly rule-based approach to a GDSS, or a fixed sequence of activities that are linearly driven by the facilitator, will inevitably fail in many situations.

Some organisational theorists (Lyles, 1981; Mintzberg et al., 1976) have found that the initial decision stimulus affects the type and amount of decisional activity that occurs; the degree of the initial decision stimulus has been shown to have the greatest impact on the range of alternatives considered and the final choice. It was found that even in GDSS environments (here, DCs), *the degree of threat had a pronounced influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options [Chun 1988b]. Using a new set of data, present study confirms this finding.*

However, *present study also presents that there were very little differences in the perceived effectiveness of DCs between the high threat groups and low threat ones; compared to a conventional meeting, the use of a DC can have same positive effects on the meeting outcomes when dealing with high threat tasks as well as low threat ones. High threat groups perceived the aid of a DC in generating alternatives and criteria quite equally high to those in low threat situations, even though they actually produced fewer options and considered fewer criteria in evaluating those options than did low threat groups.* A possible interpretation of the findings might be that participants in both situations (high as well as low threat) viewed the aid of a DC in generating alternatives and criteria was much better than the conventional meeting with the associated levels of task threat.

#### **7.1.8. The pattern of the perception of the effectiveness of DCs across evaluation criteria**

Of greater interest is the finding that certain consistent patterns in the results are obtained from the study. Although there were some variations in the perceived effectiveness of DCs according to the type of independent variables mentioned so far, we have continuously observed that irrespective of the variety of facilitators, organisation differences, nationality of the subjects, respondents' strata and main functional areas of

business in their whole working career, group size, the task differences in terms of the degree of threat, and even differences in data selection methods(whereas Peterson's data base was comprised of the more successfully executed cases which had been chosen by the facilitator himself, the data bases of Phillips and Hall were made up with the randomly selected conferences by the investigator), the perceived effectiveness of DCs shows consistent patterns for most of the 12 evaluation criteria (in case of Peterson, 10), especially within the top and bottom ranges of ordered criteria. But, unlike the orders in the top (highly effective) and bottom (less effective) ranges of ordered criteria, the orders in the middle range of evaluation criteria of perceived DC effectiveness was shown to be affected by the variables mentioned above.

A DC was perceived *highly effective* with regard to the criteria of Attitudes in terms of enhancement of problem-solving ability (Q10), Decision quality (both the number of alternatives and criteria generated. Q11, Q12), Adaptable process (Q3), Goal-centred process (Q6), and Efficiency of decision (Q5), *moderately effective* with regard to Participatory process (Q1), Data-based process (Q2), Attitudes in terms of challenge and accomplishment (Q9), and Legitimacy of decision (Q4), and *less effective* with respect to Supportability of decision (=implementation of decision Q8), and Accountability of decision (Q7).

The tendency was maintained with the managers who had attended up to 4 DCs. However, under Peterson's facilitation, the tendency was changed with very experienced users who had attended 5-6 or 8-10 DCs. For example, DCs have been consistently perceived less effective with regard to Accountability of decision (Q7) and Supportability of decision (Q8). But, managers who had attended 8-10 DCs rated the effectiveness of DCs highly with regard to these two criteria. A possible rough guess for the finding might be as follows. The lateral process in DCs may contradict the decision taker's accountability. Then, the negative perception might be more serious particularly for the first-time attendants. Because they had not experienced such a lateral process before, managers might feel that their accountability and authority were severely damaged, and at the same time they might get confused who were really accountable for the decision. Therefore, they might reject to execute the action plan when they returned to their job, even though they had ostensibly said yes during the meeting. But, along with more experiences, managers might become to adapt themselves to this rather unfamiliar process. So, they might become able to find the way to maintain their accountability and authority. At the same time, they might become clear who were truly accountable for the decision. Therefore, they might voluntarily accept the agreed action plan. However, the small sample sizes in very experienced users (n=4) limit the interpretation of the results. More research is

required to analyse the relationship between the accountability and implementation of a decision and the amount of prior experiences with DCs.

It was also found that independent of the variables mentioned so far, participants perceived quite consistently the aid of a DC to be *more effective with regard to rational and political aspects of decision-making process compared to consensual and empirical ones*, when measuring it based on four competing decision-making perspectives. It would mean that participants perceived the intervention of a DC to be more effective in terms of logical, rational, flexible, and creative process compared to the aspects of the participation of all members and thorough analysis of all relevant data.

## 7.2. Conclusion

The main findings from the current study are as follows:

1. The facilitator-associated effect on participants' perception of the effectiveness of a DC (*that is, a facilitator-driven single workstation-based GDSS*) was not a strong variable to determine the level of the perception. Its effect, however, emerged when it was compounded with other variables (i.e., culture and style of the organisation).
2. The culture and style of the organisation had an influence on how its managers approached the decision event.
3. Managers from different industries measured the effectiveness of a DC quite closely each other, if they were hosted by the same facilitator.
4. Managers in different levels perceived the effectiveness of a DC differently. The perceived effectiveness of a DC was greater at higher levels in the executive hierarchy.
5. With regard to their ideal decision making perspectives, executives at stratum VI-VII regarded the political perspective to be the most important one, and at the same time they also considered the rational perspective to be the least important one.
6. Contrary to the articulation of multi workstation-based GDSS researchers, the efficiency and participation consideration of large groups was also achieved by manually facilitated methods, not necessarily only by electronic communication channels.
7. Compared with conventional meetings, the implementation of the decision made in DC environments was not improved. Further, it is expected that this problem may become more serious in multi workstation-based GDSS settings.

8. User-access type GDSS research constantly shows that learning through repeated use of the GDSS may be required before improved performance occurs. However, the problems of technical unfamiliarity reported in the initial use of those systems can not be applied to analyst (or recordist)-access type GDSS.
9. Participants' main career effect on the perception of the effectiveness of a DC can not be ruled out.
10. The degree of threat had a profound influence on the complexity of the problem structured: high threat groups developed fewer options and considered fewer criteria in evaluating those options.
11. Independent of the numerous factors investigated here, the perceived effectiveness of a DC showed consistent patterns for most of the 12 evaluation criteria, especially within top and bottom ranges of ordered criteria. A DC was perceived highly effective in terms of user attitudes, improved decision quality, adaptable process, goal-centred process, and efficiency of decision; and less effective in terms of implementation of decision, and accountability of decision.
12. Previous research generally shows that participants' satisfaction may be dampened in user-access type GDSS environments, but results from facilitator-access type GDSS research suggest that this problem can be lessened with the adoption of facilitators.
13. Previous multi workstation-based laboratory as well as field GDSS research consistently report the enhanced participation, and also increased conflict among members.

All these findings, however, must be interpreted with caution, given the limited scope and sampling of the study. The findings were based on participants' perceptions, who had attended DCs (that is, a facilitator-driven, single workstation-based GDSS). Therefore, generalisations of some of the findings across other GDSS environments can be limited. The results were also based on a limited data base of 142 responses from 22 decision conferences. Further, there were less control over contextual and independent variables.

GDSS research at present is in the earlier stages of the process of accumulating knowledge about GDSSs, how they affect group meeting processes and outcomes (George, 1988). Further, it is still mainly in the laboratory stage (Gray & Nunamaker, 1989). Therefore, despite those limitness of the study, one of the primary contributions of this study would be to provide us with the rare opportunity to

observe the perceived effectiveness of one type of GDSSs in real world settings. That is, the study would have practical implications for the development and implementation of group decision making interventions. More extended studies involving a new and bigger size of data bases than the current study, need to be done to establish more generalisability of the findings. By doing so in an iterative fashion, we can progressively develop GDSSs that better meet the needs of broader users in various organisations.

In the meantime, the current study also raises the following issues to be explored.

1. GDSS configurations based at different institutions differ markedly from one setting to another. The designs of the experiments also differ markedly from each other. Therefore, GDSS researchers should be careful about the generalisations of their findings across GDSS studies. All of the findings across systems and across experiments must be interpreted carefully, because the findings are often the answers to different research questions.
2. Many GDSS studies lacks the theory associated with their variable choice and hypothetical relationships. A conceptual framework with criteria by which to judge the effectiveness of a GDSS is needed. It is hoped that the integration of three theories (Competing Values Approach, Stratified Systems Theory, and Human Information Processing Model) employed in this study would fulfil this requirement.
3. The facilitators must try to understand the differences in the culture and style of the organisation for they will influence the managers' decision making perspectives.
4. The generalisation of the effectiveness of a GDSS should be affected by the users' stratum differences. It also would mean that GDSS developers should consider stratum differences in designing the system.
5. GDSS research should explore its effect on the implementation of a decision. GDSS research so far has concentrated to find out its effect on decision quality, decision time, and user satisfaction. In addition to these variables, GDSS developers should consider how a GDSS can be designed to improve the level of implementation of a definitive decision.

## **APPENDICES**

<b>Appendix 1: Summary of 22 sample Decision Conferencings</b>	<b>238</b>
<b>Appendix 2: Questionnaire</b>	<b>239</b>



## Q-LIST2.XLS

	A	B	C	D	E	F	G
1	<b>SUMMARY OF SENDING &amp; RECEIVING QUESTIONNAIRE</b>						
2							
3	Date	Organisation Name	Facilitated By	Group Size	# of Quest sent	# of Quest returned	Returned Ratio (%)
4							
5							
6	<b>Conducted by DCI (Questionnaire sent June - August 1989)</b>						
7	(ZA) June 7 & Oct. 3-4 '88	Westing House Electric Corp. Communications	Peterson, C	9	9	6	67%
8							
9	(ZB) Mar. 1-3 '89	WHEC - Corporate Human Resources	Peterson, C	30	30	13	43%
10							
11	(ZC) April 18-20 '8	WHEC - Digital Systems Dept.	Peterson, C	11	11	8	73%
12	(ZD) Feb. 9-10 '89	WWOR-TV / MCA Broadcasting	Peterson, C	26	26	18	69%
13	(ZE) April 5-7 '89	KDKA-TV	Peterson, C	13	13	12	92%
14		SUB TOTAL:		89	89	57	64%
15		Ave Group Size:		17.8			
16							
17	<b>Conducted by DAU (Questionnaire sent during Aug. 8-12, 1989, and Feb. 22-25, 1990)</b>						
18	(AI) Mar. 21 '88	LSE: School Administration	Phillips, L	9	9	7	78%
19	(AJ) June 15-16 '88	Mars Confectionary	Phillips, L	4	4	4	100%
20	(AK) June 28-29 '88	Yorkshire Regional Health Autho.	Phillips, L	9	9	4	44%
21	(AL) Nov. 22-23 '88	Deloitte Haskins & Sells	Phillips, L	8	8	5	63%
22		Mgmt consultancy Div.					
23	(AM) Jan. 11-12 '89	Hunter Saphir	Phillips, L	4	4	3	75%
24	(AN) Mar. 13-14 '8	Ciba-Geigy	Phillips, L	11	11	6	55%
25	(AO) May 8-9 '89	IBM (UK)	Phillips, L	11	11	10	91%
26	(AP) Mar. 25-26 '87	ICL - Public Services Business	Phillips, L	6	5	3	60%
27	(AQ) June 9-10 '87	ICL - Division & Group Information Services	Phillips, L	18	12	6	50%
28							
29	(AR) Sept. 21-22 '8	ICL - Marketing of DC	Phillips, L	8	6	4	67%
30	(AS) Oct. 10-11 '89	ICL - UK Divisions	Phillips, L	15	15	8	53%
31	(WA) April 2-3 '87	ICL - Retail Business	Wooler, S	10	7	1	14%
32		SUB TOTAL:		113	101	61	60%
33		Ave. Group Size:		9.42			
34		Ave. Group Size of Phillips:		9.36			
35							
36	<b>Conducted by ICL (Questionnaire sent during Feb. 22-25, 1990)</b>						
37	(KG) Feb. 4-5 '86	ICL - ADS	Hall, P	16	12	7	58%
38	(KH) Feb. 16-17 '87	ICL - International operations	Hall, P	19	16	4	25%
39	(KI) June 9-10 '87	ICL - Retail Business	Hall, P	11	8	1	13%
40	(KJ) May -July '88	ICL - Local Government Business	Hall, P	10	10	7	70%
41	May 18-19, June 28-29, July 21						
42	(KK) June 1-2 '88	ICL - General Industries Business	Hall, P	9	9	5	56%
43		SUB TOTAL:		65	55	24	44%
44		Ave. Group Size:		13			
45							
46		GRAND TOTAL:		267	245	142	58%
47		Ave. Group Size:		12.14			
48		# of sample DC:		22			

Anticipated time to complete  
this questionnaire : 15 minutes

## DECISION CONFERENCE EVALUATION QUESTIONNAIRE

This questionnaire asks you for information about your job and then asks you to compare a decision conference with a conventional meeting.

Your answers to this questionnaire will be strictly confidential. This questionnaire will be treated with special care. A code number, not your name, will be used to identify the forms. The master list linking names to code numbers will be known only to the principal researchers. Even with the code numbers, this questionnaire will only be used for the purposes of this study and will be held in the possession of the researchers at all times.

For further information contact :

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\* Code number : \_\_\_\_\_

\* Date : \_\_\_\_\_

I. JOB INFORMATION

1. Your organisation's name : \_\_\_\_\_

2. Length of work experience

i) In your whole career, how long  
have you been working ? \_\_\_\_\_ years

ii) How long have you been with  
your present organisation ? \_\_\_\_\_ years

iii) How long have you been in  
your present position ? \_\_\_\_\_ years

3. In what functional area of business have you spent most of  
your career ? (e.g., Finance, Marketing, Sales, Production,  
R&D, Personnel, etc.)  
\_\_\_\_\_

4. Please give your present job title and a brief description of  
your major responsibilities :

Job title : \_\_\_\_\_

Description : \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. Please classify your job at one of the following levels :

( The next level higher than yours should describe the job of your REAL boss.)

tick  
one.

CORPORATE DOMAIN	Chief Executive Officer	
	Executive Director or Executive Vice President	
GENERAL DOMAIN	Managing Director or President (e.g., of operating company), or Specialist Director or Vice President	
	General Manager or Specialist (e.g., of Sales, Production, R&D, Finance, Personnel, etc.)	
OPERATIONS DOMAIN	Manager or Specialist in Department or Unit	
	First-line Manager or Specialist	
DIRECT HANDS- ON WORK DOMAIN	Supervisory assistant, Operator, Clerk	

## II. DECISION CONFERENCE EVALUATION

Please compare your decision conference with a conventional meeting convened in your organisation to deal with similar issues.

Mark an "X" on the scale to indicate how much you judge one type of meeting to be better than the other.

e.g.,

decision conference	conventional meeting																																
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1. All participants had ample opportunity to contribute freely to the discussion.

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2. All relevant information was considered.

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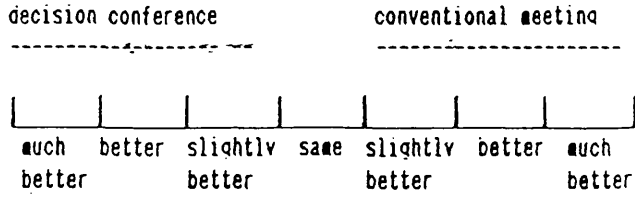
3. The decision-making process was adaptable and flexible, and stimulated creative problem solving.

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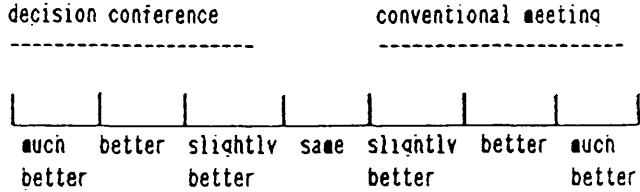
4. The resulting decisions from the meeting were accepted by other affected parties.

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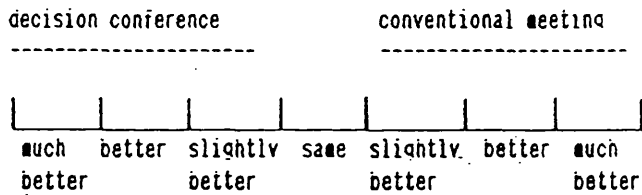
5. The meeting was worth the investment of time and effort.



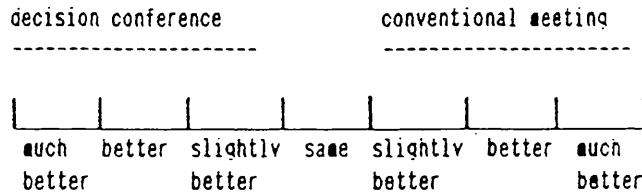
6. The decision-making process was clear and rational, and the resulting decisions were logical and justifiable in the light of available information.



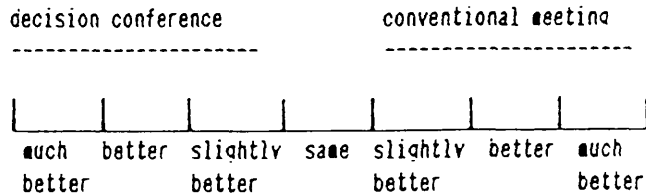
7. We left the meeting knowing who was accountable for every agreed action.



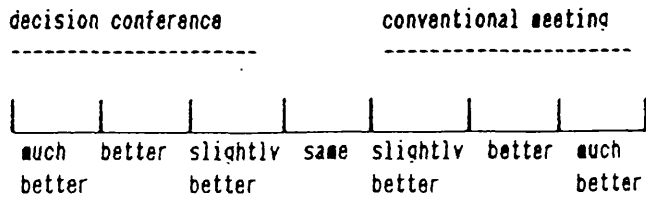
8. Actions agreed during the meeting were implemented.



9. While attending the meeting, I felt challenged to do my best work, and really felt like I accomplished something.



10. Attending the meeting was a useful learning experience.



11. The number of alternatives generated.

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12. The number of criteria considered.

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13. How many times have you attended

a decision conference ? \_\_\_\_\_

## PART II

Please rate the following aspects of decision making in the order of their importance to you. Assume that you have 100 points to allocate among the 4 aspects to show the relative importance of the items to you. For example, if the items were of equal importance to you, each item would be assigned a score of 25.

\_\_\_\_\_ Ensuring the decision is the result of a logical, rational process.

\_\_\_\_\_ Ensuring the decision is based on the participation of all interested parties.

\_\_\_\_\_ Ensuring the decision is based on a thorough analysis of all relevant data.

\_\_\_\_\_ Ensuring the decision is the result of a flexible, creative process.

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