A research framework and questionnaire for group decision support system evaluation

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Dedication

To my parents,
Joan and Cyril Stevens
A Research Framework
and Questionnaire for
Group Decision Support System Evaluation

by

Caroline A. Stevens
R.G.N., B.Sc. (Hons.), M.Sc.

A Doctoral Thesis
Submitted in partial fulfilment of the
requirements for the award of

The Degree of
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June 1995

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Abstract

Group Decision Support Systems (GDSS) have been designed to support groups of people engaged in the cooperative working activities of a meeting. The interactions of a group of people working together in a meeting are termed the “group process” whereby certain factors or input variables influence the group process which in turn characterize the group process outcomes. A review of the work in this field has revealed the absence of a standard organizing framework in GDSS research that adequately models this group process and identifies those variables recognized as characterizing the group process. The introduction of such a framework would be a significant advance in GDSS research, both improving the methods for describing and assessing GDSS-supported meetings and helping to understand the effects of input variables on the group process and its outputs. This thesis presents such a framework.

Evaluation of the group process and its outcomes is essential in studying the use of GDSS and the effects of input variables upon the group process and its outcome. Post-process questionnaires to be completed by group members have frequently been used to evaluate GDSS. However, articles describing the use of questionnaires in GDSS research provide little information regarding development of the questionnaires and the assessment of validity and reliability of questionnaires is rarely addressed. This calls into question the validity and reliability of results and conclusions drawn from questionnaire responses. In this research, a questionnaire which aims to evaluate group members’ perceptions of the meeting process and its outcomes was developed directly from the variables in the framework. The questionnaire was completed by a total of 57 group members attending five meetings using three different types of GDSS to help them with their real problems. Their responses were used to test the questionnaire for validity and reliability. The results of these tests were used to revise the questionnaire. As a result, a valid questionnaire has been devised which can be used with confidence in future research to provide valid conclusions. Use of such a standard valid questionnaire will produce comparable results from all GDSS research, promoting cross comparison of study results, more efficient interpretation of results and more fruitful conclusions. This will enhance the researchers’ understanding of GDSS use.
Acknowledgements

I would like to acknowledge the help of the following people. Thank you to Professor Paul Finlay, my supervisor, for his continual guidance, advice and support throughout this research; my directors of research Professor Dave Buchanan, Dr John Wilson and Professor John Saunders and my panel members Chris Marples and Paul Walley. Thank you to Dr Dave Coates for his help with the statistics and to Dr Cheryl Travers for her comments on the questionnaire. Thank you also to my fellow students for our informal chats particularly in the earlier stages and especially to Dr T.C. Melewar. Thank you to all those members of the Business School and Loughborough University of Technology who have helped me at various stages in my research including Max Hunt of the Computer Centre and Elaine and her colleagues in Dataprep.

I would also like to thank all those practitioners and facilitators in the field of GDSS without whose cooperation, this research could not have been carried out. Thank you to all those anonymous people who took the time to complete questionnaires for me.

Lastly thank you to my family and friends for their encouragement but in particular to my husband Dave for his tremendous support and encouragement and lastly, but by no means least, to my son Christopher Edward for his patience.
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Chapter One

Introduction
Introduction

This chapter describes the background to the research and how this led to the aims for the work presented in this thesis. The original contributions of the thesis are presented and the structure of the thesis and the general contents of each chapter are detailed.

1.1 Background to the research

Meetings form an inherent part of organizational life. Their purpose is to bring people together for the pooling of information and ideas, to allow people to discuss their views and opinions of a situation, to clarify a situation and, where appropriate, to reach a decision. Meetings are often time-consuming and can be hindered in achieving their aims by factors that arise when a group of people interact, for example problems associated with many people trying to contribute their ideas and the influence of dominant group members over the group meeting. Group Support Systems (GSS) have been designed to help groups of people working together. The term GSS covers a multitude of related systems which have been designed to support a variety of group working situations. Group Decision Support Systems (GDSS) are one type of GSS which have been designed to support the decision-making or problem solving of groups of people who are meeting at the same place and time.

The term used for the interactions of groups of people working together in a meeting is “group process”. A group process, which a GDSS is designed to support, is seen as a human activity that can be explained in “systems” terms, namely that inputs pass through a transformation process or subset of activities to produce outputs (Patching, 1993a). The group process is recognized as being influenced by a number of factors (or input variables) and the outcomes from the group process are dependent upon the characteristics of the group process. Examination of the relevant literature reveals an absence of a standard organizing framework to structure those factors which are recognized as influencing and characterizing a group process. The introduction of such a framework would be a significant advance in GDSS research, both improving the methods for describing and assessing GDSS-supported meetings and helping to understand the effects of input variables on the group process and its outputs. This thesis presents such a framework for GDSS-supported group processes.
Assessment of the group process and outcomes is essential for studying the effects of and for evaluating a group's use of GDSS. Although evaluation can occur in a number of ways, completion by group members of a post-process questionnaire is frequently used. Articles describing GDSS research provide little information regarding the development of the questionnaires and the assessment of the validity and reliability of questionnaires is rarely addressed (see for example, Nunamaker et al. (1987), Connolly et al. (1990) and Jessup and Tansik (1991)). This calls into question the validity and reliability of results and conclusions drawn from questionnaire responses. By developing a questionnaire which assesses group members' perceptions of the group process and its outcomes as a means of evaluating GDSS use and by then testing this questionnaire for validity and reliability using a variety of tests, as a result, a valid questionnaire can be devised which can be used with confidence in future research to provide valid conclusions. Use of such a standard valid questionnaire will produce comparable results from all GDSS research, promoting cross comparison of study results, more efficient interpretation and more fruitful conclusions. This will enhance the researchers' understanding of GDSS use.

1.2 Research aims

The aims of this research are:
1. Development of a research framework using the literature to identify those variables which are important in characterizing a group process.
2. Confirmation by expert assessment of the content validity of the framework.
3. Development of a questionnaire from the framework to assess group members' perceptions of the group process.
4. Assessment of the questionnaire for reliability and validity using data from suitable "real groups".
5. Development of a revised questionnaire which has been tested for validity and reliability.
1.3 Original contributions of the work

The work described in this thesis has resulted in the following original contributions to the field of GDSS.
1. Identification from the literature of those variables which are important in characterizing a group process.
2. Incorporation of the group process variables into a research framework which has been checked for content validity.
3. Use of “live groups” for the assessment of the questionnaire.
4. Production of a reliable and valid questionnaire for use by GDSS researchers.

1.4 Outline of Thesis

All the chapters in this thesis follow a similar format. Each chapter begins with an introduction, followed by discussions of the topics and closes with a review.

Chapter Two presents an examination of DSS (Decision Support Systems), from which GDSS have been developed. GDSS are introduced, including a discussion of their aims and the rôle of Information Technology in GDSS. Definitions of terms are given.

Chapter Three examines in detail the aims of this research. The usefulness of research frameworks is examined, particularly in relation to GDSS research. The importance of developing valid and reliable measuring instruments is then discussed.

Chapter Four presents a review of relevant research and literature. Past studies are subdivided into experimental research and field studies. Particular aspects of past work are examined in detail: the aims of the research, the use of field experiments as opposed to laboratory experiments, the use of student or real groups and the researchers’ use of measuring instruments to assess variables of interest. A presentation of models used by researchers to guide their GDSS research is given followed by a discussion of previous GDSS research frameworks and other relevant models. The importance of GDSS evaluation is examined and the methods for achieving this are considered. The validation of measuring instruments is discussed.
and a description is given of the different types of validity and reliability and how to
test for them. A review is presented of the validation processes adopted by researchers
developing valid questionnaires for Management Information Systems (MIS) evaluation. Attitude measurement and the use of measuring scales is discussed and the
relative merits of laboratory and field experiments are considered.

Chapter Five presents the methodology adopted in this research for achieving the
aims. An outline of the methodology is given and each stage is discussed in detail.
The methodology describes the development of the research framework and how it is
tested for content validity. The development of the questionnaire is then examined
and physical characteristics of the questionnaire are discussed. Qualitative tests
carried out on the questionnaire are considered. A discussion on data collection is
presented and the quantitative tests carried out on the questionnaire are detailed.

Chapter Six presents an overview of the structure, components and variables of the
research framework.

Chapter Seven presents the analyses carried out to test the questionnaire for validity
and reliability. Each question in the questionnaire is presented in chronological order
with the appropriate analysis and results discussed. From the respondents’ replies to
the open-ended questions included in the original version of the questionnaire, several
further questions were created and suggestions are made as to the appropriate position
for incorporating these into the questionnaire.

Chapter Eight presents a summary of the work described in this thesis and
recommends directions for future work.

Appendix One presents a detailed discussion of the research framework. It examines
the literature used to support the inclusion of each variable in the framework. Appendix Two presents the questionnaire which was devised from the framework.
The form which was completed by the facilitators, in order to provide descriptions of
the meetings for which group members completed questionnaires, is presented in
Appendix Three. The meeting descriptions, derived from the facilitator’s forms, are
given in Appendix Four. Appendix Five presents the research hypotheses on which the analyses for validity and reliability were based. An indication is given whether, as a result of the analyses, the hypotheses were supported. The questionnaire was revised as a result of the analysis; the revised version is presented in Appendix Six.
Chapter Two

General GDSS Concepts
Introduction

This chapter introduces the topic of GDSS by examining DSS and their position within the field of Management Information Systems (MIS) and Operational Research (OR). GDSS and their aims are discussed and the rôle of Information Technology (IT) in group decision support is considered. Definitions of terms related to GDSS are presented and a definition of the term GDSS as used in this thesis is given. Other relevant terms used in this thesis are defined.

2.1 Decision Support Systems and their aims

Keen and Scott Morton (1978) present a comprehensive discussion of DSS. They debate the position of DSS with respect to other relevant fields. DSS are viewed as having some affiliation with MIS and Operations Research/Management Science (OR/MS) but are distinct from both (Keen and Scott Morton, 1978). MIS impact on structured tasks, providing easier access for managers to data and aiming to increase efficiency whereas OR/MS impacts on structured problems, aiming for better solutions and offers managers new ways of handling complex problems. While DSS impact upon decisions with some structure with which the computer can cope they also require the manager’s judgement, aiming to extend the decision maker’s rationality in order to get a better or more effective decision.

DSS are designed to increase an individual’s “bounded rationality”, a term introduced by March and Simon (1958). The term bounded rationality refers to the fact that people have a limited ability to process information and comprehend their environment. Individuals can be expected to operate rationally only within the context of a frame of reference determined by the limit of their knowledge and information processing capabilities (Klauss and Bass, 1982). In decision making there are limitations with respect to knowledge of alternative courses of action, relative utility of these alternatives and the consequences of these courses of action. This is particularly true in strategic decision-making which entails long term decisions, where uncertainty exists over future events. There are limits to the ability of a MIS to provide even adequate information for decision making and the inability of the decision maker to handle intellectually the adequate information that is available. The
complexities of the problems facing organizations are so great that the executive must attempt to deal with matters by simplifying the dimensions of the problem and the possible alternatives. Rules and regulations exist to limit the amount the individual has to do, for example, people use rules to guide their search for alternatives into areas which have a good chance of yielding satisfactory solutions. Rules reduce to manageable proportions the number of possible solutions the decision maker need consider. A characteristic of bounded rationality is “satisficing” where the decision maker does not evaluate all possible alternatives but only searches until an adequate one is found which minimally meets the standards of acceptability (Behling and Schreisheim, 1976). The individual finds the most satisfactory and not the optimal alternative. As the environment becomes increasingly complex these limitations of bounded rationality are reached quickly.

DSS aim to support the manager rather than automating the method of decision-making or imposing solutions. Furthermore, the use of DSS does not cause an improvement in decision-making; this objective is achieved by managers with the support of the DSS (Keen and Scott Morton, 1978).

Keen and Scott Morton (1978) state that the term decision support implies the use of computers to:

- assist managers in their decision processes in semistructured tasks;
- support rather than replace managerial judgement;
- improve the effectiveness of decision making rather than its efficiency.

Keen and Scott Morton (1978) stress the importance of the distinction between effectiveness and efficiency as there is often a conflict between the two. Efficiency of the decision-making process is usually measured in terms of time and cost savings. In contrast, effectiveness of the decision-making process is concerned with how well implementation of the decisions brings about the intended consequences. To assess effectiveness of a decision requires an understanding of the many variables that may affect the performance of the implemented decisions.
2.2 Group Decision Support Systems and their aims

Group Decision Support Systems (GDSS) have developed from an expansion of DSS in order to support group decision making as opposed to individual decision making (Kraemer and King, 1988). Two definitions of GDSS are frequently cited. Huber (1984) describes a GDSS as "a set of software, hardware and language components and procedures that support a group of people engaged in a decision related meeting". DeSanctis and Gallupe (1985) define a GDSS as an "interactive computer-based system that facilitates the solution of unstructured problems by a set of decision-makers working together in a group".

The emphasis is on offering direct and immediate support to a group of people engaged in a decision meeting (Finlay and Marples, 1991). GDSS are seen as a means of increasing the productivity of decision-making meetings while not reducing and, ideally, enhancing the quality of decision outcomes (Kraemer and King, 1988; Finlay and Marples, 1991). DeSanctis and Gallupe (1987) state that the aims of a GDSS are to remove communication barriers, structure decision analysis and direct the pattern, timing and content of discussions.

GDSS can draw on aspects of three technologies to achieve its design aims, namely, communication, computer and decision support technologies, that is, decision modelling methods (DeSanctis and Gallupe, 1987). Thus GDSS alter the nature of participation within a group leading to an impact on the decision quality and outcomes of the meeting.

GDSS can be used by groups engaged in cooperative work on any one or a combination of the following tasks, namely, problem structuring, choosing among options, information passing, negotiation and other aspects of cooperative work (Stevens, 1993). These tasks are performed by groups in order to achieve its aims. Phillips and Phillips (1993) state that the general aims of a facilitated work group are to achieve a shared understanding of the issue facing the group, a sense of common purpose and a commitment to action. In this research a broad view is taken of a cooperatively working group's objectives to include solving problems, reaching an
understanding of a situation, resolution of relevant issues and/or reaching decisions. (These terms are used interchangeably in the thesis to refer generally to the group’s objectives.) Thus, GDSS can be used to help a group achieve a variety of aims by supporting a variety of cooperative work tasks.

2.3 The rôle of IT in GDSS

Previously cited definitions of GDSS demand IT as a component of GDSS and the origins of GDSS in MIS further stress the IT aspect. In the previous discussion of GDSS terms associated with computer technology are frequently used. Eden (1990) finds that much of the literature on GDSS assumes that computers are an essential part of the support, but stresses that “group decision support clearly need not be computer dependent”. The term GDSS can apply to any “designed process or method that has specific characteristics that attend to the particular issues of providing support to a group rather than an individual” (Eden, 1990).

Using the degree of computer technology as a distinguishing factor, Eden (1992a) classified GDSS into three classes as follows.

1. Those which rely heavily on computers to support groups, requiring direct keyboard entry from members of the group, for example, GroupSystemsV (Ventana Corporation at Tucson, Arizona).

2. Those systems that are facilitator driven but use the computer as an integral part of the GDSS, for example, Decision Conferencing which uses the computer package HiView, SODA (Eden, 1988) using COPE, Strategic Choice (Friend and Hickling, 1987) using STRAD, Teamworker (Gear and Read, 1993b).

3. Those GDSS that rely solely on the facilitator with no computer at all, for example, SSM (Checkland, 1981) and JAD (Joint Application Development) (Kettelhut, 1993).

Very generally, the first category above is indicative of the type of GDSS emanating from the United States (US) while the second and third categories are more representative of the European stance. GDSS designed in the US emphasize the rôle that computers play in supporting a group in its problem solving activities; computers
are an inherent part of the support system. However, in Europe, GDSS rely more on the methodology developed from decision-making theory and on the skills of the facilitator with computers playing either a supplementary rôle to aid analysis or are absent.

Phillips (1990) argues against the use of computers as the “linchpin” of GDSS. He quotes from DeSanctis and Dickson (1987) that the most fundamental activity of group decision making is interpersonal communication and the primary purpose of a GDSS is to improve group communication activities. Gear et al. (1993) also stress the communication aspects of decision-making stating that the aim is to provide a common language between individuals in the group. “An appropriately organized group communication process is a necessary condition for achieving a good decision” (Gear and Read, 1993a). Communication is a means for exploring uncertainties, forming preferences, making judgements and taking decisions (Phillips, 1990). For the group to perform these activities it requires more than just a computer to aid communication.

Phillips (1990) emphasises that the effectiveness of Decision Conferencing, the GDSS for which he acts as facilitator, is the result of several factors one of which is IT placed at the service of the group for combining parts of the model and facilitating an instant replay of results. For Phillips (1990) the computer is just one of a number of factors enabling the success of a GDSS.

Thus the rôle of the computer is frequently assumed to be an essential part of the GDSS but for many systems it plays only a supplementary rôle to that of the methodology designed to improve the group’s outcomes and to the facilitator’s skills.

2.4 Related terms in use

There is a number of terms used in the fields related to GDSS including Group Support Systems (GSS), Computer-based Support for Cooperative Working (CSCW) and Electronic Meeting Systems (EMS). It is possible to distinguish between the various terms according to the type of support they provide. Nunamaker et al. (1989)
use the term GSS as an all-encompassing term to include many aspects of GDSS such as decision rooms, decision conferences, computer supported conference rooms, teleconferencing and electronically supported meetings. CSCW provide a means for small groups to communicate more efficiently as opposed to GDSS which are more task oriented in that they provide a means for a group to work on and complete a task such as reaching a decision, planning or solving a problem (Dennis et al, 1988). Martz et al (1992) define EMS as systems that provide an “Information Systems infrastructure to support work groups and the activities they use in their meetings”. As may be expected, the distinctions between some of these systems are ill defined (Dennis et al, 1988).

2.5 Thesis use of the term GDSS

From the previous discussions of the aims of a GDSS, the rôle of IT as a component of GDSS and the use of related terms, it is important to make a statement about how the term GDSS is used in this research and to what it refers.

In this thesis the term GDSS refers to any designed process or method, not necessarily computer-dependent, which supports a group of people whose objectives can best be achieved by:

- people coming together at the same place and the same time as representatives of different interests from within an organization or from different organizations;
- to exchange information and views on a situation of importance and relevance to the organization(s);
- to develop a group understanding of a situation;
- and where necessary, to find a solution or make a decision as to the appropriate response required to a situation faced by one or more group members' interests. It may be that both the situation and response have important consequences for member interests that are not directly concerned with the problem.
2.6 Definition and use of other relevant terms

A number of other definitions of terms used in this thesis are also presented here.

Firstly, DeSanctis and Gallupe (1987) define a decision making group as “two or more people who are jointly responsible for detecting a problem, elaborating on the nature of the problem, generating possible solutions, evaluating potential solutions and formulating strategies for implementing solutions”. It has already been discussed that the term “decision-making” will be used in a broad sense to also include problem-solving and understanding of a problem situation. The reasoning behind this is substantiated by Olsen’s (1982) definitions of a problem and decision making. A problem is “a discrepancy between two types of knowledge; factual knowledge, or knowledge of what is, and deontic knowledge, or the collection of ones images about what ought to be” while decision making is “the reaching of a conclusion on the basis of reasoning from premises by connected thought”.

Secondly, the terms process, group process or group interaction process are frequently used interchangeably in the thesis. Olsen (1982) defines group process as consisting of “all the actions taken by the members of the group, individually and collectively, in the performance of a given task. It includes all those intra and interpersonal productive and non-productive actions by which people transform information and matter energy into a product”.

Olsen (1982) defines a group as “a body of individuals in interdependent relations having a set of values (norms) that regulate the behaviour of members in matters of concern to the group”. The terms “group members” and “participants” will be used to refer to those people within the group which is using a GDSS.

Review

In this chapter the origins and aims of DSS and GDSS have been discussed. The rôle of IT in GDSS has been examined. Definitions of terms used in the thesis and of other relevant terms have been presented.
Chapter Three

Development of Research Aims
Introduction

The aims of the current research were presented in Chapter One. This chapter describes these aims in greater detail by discussing the usefulness of frameworks, their relevance to GDSS and the importance of instrument validation.

3.1 Usefulness of frameworks

A framework, in the theoretical sense, is a structure for modelling a subject. The usefulness and benefits of a framework have been discussed by a number of researchers. Sprague and Watson (1986) stressed that, in the absence of theory, a framework is helpful in organizing a complex subject, identifying relationships between constituent parts and revealing areas which require further development. Many fields of study can benefit from the use of a framework to classify past and present research and from which potential research hypotheses may be generated (Ives et al., 1980). The framework can be used to identify variables of interest for future research.

Frameworks are also useful for predicting what may happen in a certain situation. Mackay et al. (1992) in discussing an individual's problem-solving process, describe how one major purpose of building frameworks and identifying stages in problem solving should be to predict the behaviour or performance of a problem solver on a specific task. Any theory or model of problem solving should be able to explain how a person solves a problem, what processes are used and what mechanisms are used to carry out these processes.

In practice, developing an all-encompassing framework to explain a complex topic is difficult; variables within the framework may be expected to change as research provides greater insight into the area under study. Klauss and Bass (1982) discuss the measurement and impact of communication in an organization and state that although it may be possible to develop a causal model of communication it is difficult to provide evidence to support it. Nevertheless, they feel that thinking in causal terms helps to improve one's understanding of the field under study and in turn may assist in improving simplified models of reality.
3.2 A framework in the field of GDSS

The group decision process is extremely complex. It potentially contains a large number of variables. This presents difficulties in drawing firm conclusions about how GDSS influence group processes and the resulting outcomes, particularly in different problem-solving settings. Many variables have been suggested as possibly influencing the outcome and success of meetings (see Chapter Six and Appendix One).

Many studies have been conducted under laboratory conditions with university students as the subjects (Gallupe and DeSanctis, 1988; Jessup and Tansik, 1991; Lewis, 1987; Zigurs et al., 1988; Watson et al., 1988), while several field studies have been carried out using managers operating in real organizations (Nunamaker et al., 1987; Nunamaker et al., 1989). This work has shown that while a number of researchers develop models or frameworks of a group process from which to design their studies, there is no widely-accepted organizing framework. Laboratory studies are useful for identifying and studying, under controlled conditions, the impacts of various input variables on group process and outcomes. They enable researchers to test hypotheses upon which the designed GDSS are based; for instance, the effect of contributing anonymously to the meeting on the degree of participation of participants (Hiltz et al., 1989; Jessup and Tansik, 1991; Jessup et al., 1990; Nunamaker et al., 1988). However, as Pinsonneault and Kraemer (1989) emphasize, at some stage research needs to be conducted in a field setting with those variables researched in the laboratory in order to achieve external validity for the findings. Under these circumstances, researchers have less control over contextual variables than in a laboratory setting and will need to identify carefully and meticulously report the context in which the study is conducted. In these circumstances, a framework which specifies those variables that characterize the context of a group process would be of great use to researchers.

To obtain meaningful, results GDSS research must be well structured. There is a need for a carefully developed, strong research framework from which research into GDSS can be conducted, results determined and findings published. Such a framework could be used as a means of identifying research variables, thus ensuring consistency in
reporting findings. In this way a more complete model of GDSS use can be established.

3.3 The importance of instrument validation

This research aims to produce a standard, validated questionnaire as a measuring instrument for assessing group members' perceptions of a GDSS supported meeting process and its outcomes. Sproull (1988) discusses the importance of validating measuring instruments. Validation of measuring instruments involves carrying out a series of tests to check that the instrument measures what it is supposed to measure and that it does so accurately and reliably. The data collected using the measuring instrument must be accurate in order that true conclusions can be drawn about the hypotheses made concerning the construct under investigation. “If an instrument does not measure accurately what it is supposed to measure there is no reason to use it” (Sproull, 1988). The need for initial results to be accurate is important because from the conclusions based on these results, further research may be designed.

A perfectly valid instrument measures data completely and accurately and reflects faithfully any unobservable research constructs under consideration. However, in reality, instruments will measure some data inaccurately. Carrying out tests on the instrument allows researcher to gauge the extent to which the instrument measures accurately (Straub, 1989).

The need for validated measuring instruments in the field of GDSS has been recognized by Zigurs (1993) who found a dearth of information about measuring instruments in GDSS research. She recommends that more attention be paid to the development and evolution of measuring instruments and asks for explanations to be provided as to how instruments are developed. Zigurs (1993) also calls for the need to share measuring instruments, recognizing that the process of instrument development and validation is a major effort. Hence, a validated questionnaire produced from a comprehensive framework would be of significant importance.

Researchers in the related field of MIS have acknowledged a lack of instrument
validation in their field and have discussed the consequent problems. Their discussions and comments are of relevance to GDSS research.

Ives and Olson (1984) carried out a review of research into computer-based information systems (CBIS) and concluded that a "consistent lack of rigor in research to date seriously limits understanding of the nature of user involvement in CBIS development". They considered that inaccurate results are often due to the use of poor instruments which stems both from the lack of a conceptual foundation on which to guide measurement development and from the absence of a rigorous programme of measurement validation. Ives and Olson (1984) stressed that future research in CBIS should pay rigorous attention to measurement, in particular, to development and validation of standard measures for user involvement and satisfaction.

Straub (1989) advocates strongly the need to validate measuring instruments in the field of MIS. He reviewed 117 MIS studies and found that 62% failed to carry out even one test of instrument validation. He believes that greater attention to instrumentation promotes cooperative research efforts as it allows further confirmatory research to make use of a tested instrument. This results in improved and consistent measurements of variables which enhances the drawing of conclusions from research (Baroudi and Orlikowski, 1988). "By allowing other researchers to use the tested instrument across both heterogeneous settings and times, brings greater attention to instrumentation and also supports triangulation of results" (Cooke and Campbell, 1979). A valid measure also allows practitioners and researchers to use a readily available instrument, thereby avoiding the time consuming process of developing a new measure each time an assessment of "User Information Satisfaction" of MIS is required.

The need for a standard questionnaire as a measuring instrument in MIS has been stressed by several researchers. Use of such questionnaires supports cross-study comparisons of results, for example, across departments systems, users organizations and industries (Ives and Olson, 1984; Baroudi and Orlikowski, 1988). Straub (1989) suggests that the lack of instrument validation may be due to the fact that in a traditionally technology-driven field such as MIS, windows of opportunity for
gathering data appear and disappear so rapidly that researchers often feel they cannot afford the time to validate measuring instruments. The same may be true for IT-based GDSS.

Straub (1989) argues that paying attention to instrumentation brings greater clarity to the formulation and interpretation of research questions. In the process of validating an instrument it is possible for the researcher to carry out a "reality check" to ensure that conceptualization of problems and solutions matches the actual experience of practitioners. Using an non-validated measure means that no finding in the study can be wholeheartedly trusted.

Straub (1989) concludes that instrument validation is a primary process in confirmatory empirical research. "Numerous research streams would gain credibility from more carefully articulated constructs and measures" and instrument validation can move the field of study "towards meaningfully replicated studies and refined concepts".

Review

Thus a framework is useful for modelling a complex subject, for predicting behaviour, for classifying both past and present research and for identifying research variables for future studies. The need for a standard validated measuring instrument developed from a rigorous conceptual foundation has been presented. In this research it is intended that the measuring instrument will be developed directly from the framework. Although the framework has been devised from an in-depth review of both the relevant literature and the published studies and should therefore be conceptually valid, the validity of both the framework and questionnaire will need to be investigated in the current work.
Chapter Four

Research and Literature Review
Introduction

This chapter commences with a review of GDSS research. It is divided into experimental research and field studies. An overview of each study is given with those aspects of the studies most relevant to this research presented. A resumé of past research follows, highlighting the pertinent features. Frameworks used by researchers of GDSS are examined and several models of organizational and group functioning are presented. A discussion follows of the evaluation of GDSS, focussing on the use of questionnaires. A number of types of validity and reliability is then reviewed and the methods for testing a measuring instrument for these is presented. The methodologies adopted by several researchers for producing valid and reliable instruments are examined. Methods of attitude measurement are considered together with a discussion on measurement scales. The chapter closes with a discussion of the relative merits of laboratory and field experiments in GDSS research.

4.1 Research studies

Research studies of GDSS can be classified broadly into two categories, namely, experimental research and field studies. Experimental research generally involves some manipulation of the support facilities and is concerned with either studying the effects of a specific aspect of a GDSS on the group process and outcomes or comparing the effects of using a computer based GDSS with those of manual or no support. Field studies are concerned with the use of GDSS by organizations during an actual decision making session with no manipulation of conditions.

These research studies represent a major tranche of work carried out into GDSS and mainly emanate from the US. There is little published experimental research from Europe. Papers from UK researchers tend to be more descriptive in nature, favouring either a detailed case study of GDSS use or discussion documents on topics relevant to GDSS. The lack of experimental work in the UK may be due both to differences in the stance taken of the validity of experiments into GDSS use and to differences in GDSS design. The American tendency for computer based GSS may be more amenable to experimentation.
The relevant past research is discussed in the next two sections: section 4.2 reviews GDSS experimental research while section 4.3 reviews field studies. A resumé of each study will be given, highlighting the aims, experimental design, subjects used, the type of problem tackled and which variables were measured and how. Those aspects of the studies most relevant to this research are considered and the principal conclusions which can be drawn from the review are discussed in section 4.4. Results of the studies are not discussed in this chapter as relevant findings have been incorporated into the research framework, described in detail in Appendix One. The studies reviewed do not represent an exhaustive list but are representative of the type of GDSS research carried out.

4.2 Experimental research

The first studies examined are those in which researchers used control groups and manipulated experimental conditions to study the effects of using a GDSS. These experiments are divided into two classes. The first class is concerned with studies comparing the benefits of using a computer based GDSS with manual support or no support. Manual support refers to the use of "paper and pencil" support, as it is sometimes termed, as opposed to facilitated and/or non-computer based support. The second class of experiments focus on one particular aspect of the GDSS, namely, anonymous input of group member's contribution to the group process. This aspect of GDSS is the one most frequently researched.

4.2.1 Computer based versus non-computer or no support


Aim: To study the effects of computer based support for group problem-solving.

Experimental design: A 2x2 Latin square design crossing GDSS support and non-GDSS support against higher and lower task difficulty.

Subjects: Undergraduates working on a fictional problem.

Measurement of variables:

a) Perceived reaction of group members to a decision-making session was measured by a post-test questionnaire using a 7 point Likert scale asking subjects to rate their
confidence in the decision, satisfaction with the process, the amount of discussion conflict and their agreement with final solution.

b) Decision performance was measured by the decision quality, as judged by experts, and the number of alternatives generated by content coding the groups' remarks.

2. Jarvenpaa et al. (1988)

Aim: To study the effects of groups using computer support to work on unstructured problems.

Experimental design: A 3x3 Graeco-Latin design in which participants encountered three types of task and three types of support, namely, networked personal workstations, computer based electronic blackboard and conventional manual support.

Subjects: 21 software designers working on fictional problems.

Measurement of variables:

a) Researchers assessed communication thoroughness by counting the number of thoughts recorded, number of verbal remarks exchanged in the meeting and number of task related remarks.

b) Subjects completed a 7 point Likert scale questionnaire concerned with assessing perceived equity of participation and contribution of members to the task in relation to the proportion of time spent speaking. Satisfaction was measured by four items, overall satisfaction, level of agreement in meeting, perceived progress toward the task goal and perceived freedom to participate in meeting.

c) Quality of the team performance was judged independently.

3. Lewis (1987)

Aim: To determine the impact of GDSS on group product and group process.

Experimental design: Studied the benefits of using a computer based GDSS for face-to-face groups versus a book based GDSS or no support at all.

Subjects: Business undergraduates working on a real problem in a laboratory setting.

Measurement of variables:

a) The number of alternatives considered was measured by content coding remarks.

b) The quality of the solutions was rated.
c) Subjects completed a post-experimental questionnaire to assess the number of alternatives considered, the quality of solutions, the degree to which the process was dominated by one person, the creativity of the process, an individual's chance of being heard, the acceptance of a member's contribution, the level of member commitment, the ease of GDSS use and satisfaction with the method. The questionnaire used 5 point Likert scales.

4. MacKay et al. (1992)
Aim: To study the effects of decision aids on the problem-solving process.
Experimental design: Six conditions of decision aid and familiarity with IT (familiar/unfamiliar) against task familiarity (familiar/unfamiliar) and no decision aid with task familiarity.
Subjects: 18 professional people working on a fictional but realistic problem.
Measurement of variables:
Four variables were measured by content coding verbal comments made by the groups such as time to reach the final solution, time spent in each of the problem solving steps, number of activities or actions in each of the problem solving steps and the time required to identify a potential solution.

5. Sharda et al. (1988)
Aim: To evaluate the effectiveness of a DSS on decision performance.
Experimental design: Compared the use of a DSS with non-DSS supported groups on a semi-structured task.
Subjects: Business undergraduates working on a computer assisted simulation that modelled a business environment.
Measurement of variables:
a) To assess effectiveness the researchers measured total revenue, net earnings, net cash flow, net assets, income and market share.
b) To measure efficiency, researchers relied on a self-report of the amount of time spent in decision-making, the number of alternatives considered and confidence with the decision, measured on 10 point Likert scales.
Aim: To compare the process and outcomes of face-to-face meetings with a computerized conference system providing a communication tool.
Experimental design: Used a 2x2 factorial design crossing the type of problem against communication mode.
Subjects: Undergraduates in a laboratory.
Measurement of variables:
Experiment 1
By content coding the groups' interaction using Bale's (1950) Interaction Process Analysis (IPA), researchers measured the degree of consensus, decision quality, number of opinions given and amount of tension release (laughing and joking).
Experiment 2
Replicated experiment 1, but used managers as subjects in a computerized communication environment.

Aim: To study the effects of using a GDSS to facilitate group consensus.
Experimental design: Studied the effects of three levels of support, namely computer, manual and no support on the degree of post-meeting consensus.
Subjects: Watson \textit{et al.} (1988) used student groups which they called “live groups” as they had been actively working together as teams on other class assignments. This avoids the initial socialization that occurs early in group formation.
Measurement of variables:
\begin{itemize}
\item[a)] Consensus and equality of influence were measured by a two stage process following specific techniques involving the comparison of the relative distance of an individual’s solution from the group’s solution.
\item[b)] Group attitudes were measured using a post-meeting instrument consisting of 5 and 7 point Likert scale questions. The questionnaire asked questions such as “How would you describe the group problem solving process? To what extent are you confident that the group’s solution is correct? Did you make suggestions about doing the task? Did anyone emerge as an informal leader? To what extent does the final solution reflect your inputs? How easy or difficult did you find the task in a
\end{itemize}
8. Zigurs et al. 1988

Aim: To investigate the effects of influence behaviour upon the group process where influence behaviour is defined as individual verbal or other acts that attempt to affect or determine the course of group behaviour.

Experimental design: Compared the influence behaviour of half the groups using computer support with the remainder who were provided with an equivalent paper and pencil agenda.

Subjects: Undergraduates in a laboratory experiment.

Measurement of variables:

a) The distribution and pattern of influence behaviour within the group were measured by coding verbal acts into 1 of 10 categories.

b) Observers rated members’ influence behaviour and influential use of group support, for example, non-verbal behaviour or messaging.


Aim: To study the impact of computer support on influence behaviour in decision making groups.

Experimental design: Compared groups using computer support with groups using an equivalent paper and pencil agenda.

Subjects: Novice users of the system working on a realistic problem.

Measurement of variables:

From audio tapes and written transactions of the group interaction, coders classified every verbal act of each group member into a 10 category system for coding interaction.

4.2.2 Effects of a particular GDSS feature

The studies in this section are concerned with investigating the effects of certain features of the GDSS on group performance criteria. The most widely studied characteristic is that of anonymity of group members’ inputs.
1. Connolly et al. (1990)

**Aim:** To evaluate the effects of anonymity and evaluative tone on the performance of groups using a computer based GDSS to generate ideas.

**Experimental design:** Used a 2x2 factorial design crossing anonymity (anonymous/identified) with evaluative tone (critical/supportive).

**Subjects:** Business students working on a true problem in a laboratory experiment.

**Measurement of variables:**

a) Content coding of groups' computer files and classification of ideas, comments and suggestions.

b) Group overall effectiveness in generating ideas was measured by asking experts to assess the number of acceptable ideas generated by each group and to rate their merit.

c) A post-experimental 7 point Likert scale questionnaire completed by the subjects assessed their satisfaction with the system, the group process, the ideas generated and the evaluations, their overall satisfaction, the systems' effectiveness at using member skills, evaluating ideas and generating ideas, their willingness to remain in the group and their enjoyment of the meeting.

2. Hiltz et al. (1989)

**Aim:** To study the effects of anonymity on the group process.

**Experiment 1**

**Experimental design:** A 2x2 factorial design comparing the process and outcomes of face-to-face versus computerized conferences for two types of task.

**Subjects:** Business managers.

**Measurement of variables:** The interaction process was coded using Bales' (1950) IPA.

**Experiment 2**

**Experimental design:** Compared the process and outcomes of three communication modes, namely, face-to-face, computerized with non-anonymous input and computerized with anonymous input.

**Subjects:** Business managers.

**Measurement of variables:**
a) Content coding of the groups’ remarks measured equality and amount of participation, disinhibition by counting the number of insults, profanity and disloyalty and deindividuation by measuring subjects’ degree of agreement with the final group choice.

b) A post-session questionnaire asked members for demographic data and assessed their reaction to the problem situation and their satisfaction with the discussion process and outcome.


Aim: To investigate the effects of interaction frequency upon group brainstorming. The researchers hypothesized that automated brainstorming groups operating under conditions of infrequent, punctuated interaction will be more effective at generating ideas than groups with more frequent interaction, pooled groups or individuals working alone.

Experimental design: Various interaction requirements were imposed on groups.

Subjects: Business students.

Measurement of variables:

a) Content coding of remarks measured the number of comments and total ideas generated during the sessions.

b) Subjects completed a post experimental questionnaire consisting of a 7 point scale.

4. Jessup et al. (1990)

Aim: To determine using an idea generating task whether anonymity influences the group interaction process.

Experimental design: Comparison of anonymous with non-anonymous working conditions.

Subjects: Business students working on a real problem in an IT environment.

Measurement of variables:

By content coding the computer files, comments were classified into 13 categories to measure variables such as solution clarification, critical comments, questions about solutions, number of ideas generated, supportive comments and comments about the system and the group.

Aim: To study the effects of anonymity and proximity on a group process when the group are working in an automated GSS environment.

Experimental design: Used a 2x2 factorial design crossing anonymity (anonymous/non-anonymous) with proximity (face-to-face/dispersed).

Subjects: Business students in a laboratory experiment.

Measurement of variables:

a) Computer files were content coded to measure the total number of comments, number of original proposed solutions, number of critical comments and number of critical arguments.

b) Subjects completed a post-experimental questionnaire which assessed their overall satisfaction, their satisfaction with the group process, the system, the ideas generated and the evaluation of ideas, the effectiveness of the system at using member resources, generating ideas and evaluating ideas, the helpfulness of the system in completing the task and the subject's willingness to remain in the group as a measure of cohesiveness. The questionnaire used 7 point Likert scales.

6. Siegel et al. (1986)

Aim: To study the effects of computer mediated communication on communication efficiency, participation, interpersonal behaviour and group choice.

Experimental design: Used a 3x3 Latin square design of three conditions, face to face (non-anonymous), IT with non-anonymity and IT with anonymity crossed with three problem types.

Subjects: Students.

Measurement of variables:

By content coding of remarks four variables were measured: communication efficiency measured by the time it took the group to reach consensus, number of remarks exchanged, task oriented remarks and decision proposals as proportions of total remarks, social equalization measured by the distribution of remarks among group members, uninhibited communication and choice shift.
Review

In this review of experimental research, nine studies compared the use of computer-based GDSS with manual or no support and six studies observed the effects of particular aspects of the GDSS on group process. It is the trend for these experiments to be carried out in a laboratory with students as subjects; the laboratory being an appropriate setting for experiments where manipulation of variables occurs. It would be difficult to perform such experimental manipulation with real groups.

4.3 Field studies of DSS and GDSS

The studies reviewed in this section observed the effects of DSS and GDSS when used in real problem-solving situations.

1. Guimaraes et al. (1992)

Aim: To measure the effects of inputs on DSS success.

Study design: A model of the determinants of DSS success was devised from which a number of hypotheses was postulated to test the effects of various inputs on DSS success. A questionnaire was then designed to measure each of the variables in the model.

Subjects: Business managers who returned 118 questionnaires.

Measurement of variables:

a) A questionnaire completed by subjects measured four categories of input variable:
   i. characteristics of the implementation process, for example, user involvement, user training, top management support;
   ii. characteristics of decisions and tasks, for example, degree of task structure, uncertainty, difficulty and variety;
   iii. characteristics of the decision maker, for example, level of managerial activity and DSS experience;
   iv. characteristics of the DSS, for example, managerial level, phase of decision making process supported and information sources used by DSS.

b) DSS success was assessed using a 13 item scale developed by Sanders and Courtney (1985) which measured user satisfaction and an 8 item scale which measured perceived benefits. The questionnaire used a 5 point Likert scale.
2. Martz et al. (1992)

Aim: To study groups from companies using their Electronic Meeting Systems (EMS) facilities.

Subjects: Managers attending 59 sessions from which a set of performance data and group and task characteristics were collected.

Measurement of variables:

a) Facilitators completed a group dynamics questionnaire which assessed variables such as task difficulty, size, complexity, clarity, task knowledge of the group, cooperation requirements and task type, group homogeneity, management height, group width, history, familiarity, cohesiveness, newness and formality.

b) Researchers asked group members for their experiences of the group process.

c) The meeting process was mapped by reviewing documents produced during the process and by talking to the facilitator and project leader. The outcome variables measured were project length, the number and length of meetings, administration costs and man hour dollar costs.

3. Nunamaker et al. (1987)

Aim: To study the effects of automation on the idea generation and analysis process.

Subjects: Managers using the laboratory for planning sessions.

Measurement of variables:

a) Pre-session questionnaires collected demographic data and assessed previous use of and familiarity with computers.

b) A 10 point Likert scale post-session questionnaire measured members' satisfaction with the outcome of the planning session, with the process used to achieve the outcome and with the idea generation models used. Subjects were asked to compare the computerized GDSS with the manual version of brainstorming. Open-ended questions asked subjects to list 10 factors associated with the technology that helped them to generate ideas.

c) Participant observation provided an overview of the idea generation and analysis process by classifying group interactions.

d) Structured observations provided quantitative data.

Aim: To assess the use of an operational group support system in an organizational setting from the experiences of IBM.

Subjects: Real groups.

Measurement of Variables:

a) Content coding of log files was used to measure equality of participation as a GSS effectiveness indicator of the quality of the session process.

b) A post session questionnaire measured, on a 5 point Likert scale, subjects' feelings concerning the computer aided process, such as its comparison with the manual process, its help in aiding the group to generate ideas, identify key areas and achieve its goals, whether the group's problem solving process was efficient and whether they were satisfied with the computer aided process.

c) A follow-up interview assessed GSS effectiveness in terms of quality of the session outcome. Participants were asked questions such as "What has happened as a result of the automated session? How would you rate the effectiveness of the automated session? What has been done with the data generated during the session? How would you compare the automated process with a similar manual process? What do you consider are the advantages of using the automated system?"

d) GSS efficiency was measured by comparing the group leader's prior estimate of the number of man hours needed to complete the decision with actual man hours.

e) Post-process utilization rates of GSS were maintained as an indicator of acceptance and satisfaction.

5. Sainfort et al. (1990)

Aim: To measure the impact of structural variables upon the process and nature of the outcomes in order to evaluate the effectiveness of two decision support technologies.

Subjects: Volunteer couples in real conflicts.

Measurement of variables:

a) Structural variables representing independent variables were measured in a pre-test questionnaire consisting of two main categories. Firstly, individual's demographic data was recorded, such as sex, age and education. Secondly, perceived severity of the problem was measured by assessing the perceived importance and occurrence
of the problem, perceived urgency of solving the problem and perceived need for change in this situation.

b) Seven process variables were measured including perceived degree of problem understanding, number of alternatives, perceived overall quality of alternatives, perceived clarity of choice strategy and perceived clarity of implementation strategy. These variables were measured twice, both pre-test and immediately post-test.

c) Outcome variables measured were perceived progress in resolution of the problem, perceived usefulness of the technology, actual implementation of a solution and perceived degree of success of solution. These variables were measured twice, immediately post-test and one month after the test. The questionnaires used 9 point Likert scales.

6. Sanders and Courtney (1985)

Aim: To study the influence of users’ task environment on DSS success.

Subjects: DSS users in organizations.

Measurement of variables:

a) Input variables measured included demographic variables of users and organizations, for example, type of organization, education of user, position of user in organization, types of application of DSS and task variables such as newness, difficulty, variability, interdependence and standardization, length of time user has been using DSS, user training and top management support.

b) Criteria used to measure DSS success were overall satisfaction with the system and decision-making satisfaction as an indicator of improved decision making, measured on 5 point Likert scales.

Review

In this section 6 field studies were reviewed which researched the effects of input variables on DSS and GDSS use by managers in real problem solving situations. While experimental research, reviewed in the previous sections, focussed on assessing the process, the field studies concentrated on measuring input variables such demographic data and task variables.
4.4 Resumé of research studies

Sections 4.1 to 4.3 examined studies typical of those carried out in GDSS research. Studies in GDSS were broadly divided into three categories, those comparing the use of a GDSS with no group support, those studying specific aspects of the GDSS (frequently anonymity of input) and those studying the use of a GDSS in the field. Several important points relevant to this current work arose from this review.

Firstly, a number of researchers generated their own model of a group decision process to guide the design of their research and which then determined the variables to be measured. A description of some of these models is presented in section 4.5. These frameworks bear resemblances to each other but researchers do not use a standard framework which would make cross-study comparisons easier and more efficient.

Secondly, researchers study a variety of input, process and output variables; the choice of which variables to measure being dependent on the particular area of interest of the researcher. Frequently measured variables included members' satisfaction with the process and perceived equity of participation by group members.

Thirdly, content coding and post-process questionnaires are frequently used for measuring variables. Of the 15 experimental studies reviewed 9 (60%) used post-experimental questionnaires and 13 (87%) used content coding of the group process interaction. Of the 6 field studies, 5 (83%) used a post-meeting questionnaire while 2 (33%) used content coding or process mapping. While content coding assesses what took place in terms of communication and interaction, post-test questionnaires measure process inputs, such as group member demographic details and process outputs, such as members' reactions to using the GDSS.

The review also highlighted that the type of research undertaken appears to be dependent upon the available facilities of the educational establishment; for example, whether there is access to real groups using GDSS facilities and the preference of researchers to performing laboratory-based as opposed to field research using real
groups. For example, Jessup et al. from California State University focus on laboratory experiments using student groups, while Nunamaker et al. from the University of Arizona study real groups using their GSS facilities in real problem solving situations.

The important features of past research highlighted in this section are discussed in greater detail in subsequent sections of this chapter. These include the use of research frameworks and the choice of variables to measure, evaluation of GDSS and, in particular, the use of post-process questionnaires and laboratory based or field experiments.

4.5 GDSS research models used by researchers

In the review of past research (sections 4.1 to 4.4), it was seen that a number of researchers used models of a group process from which to design their studies and for identifying variables to investigate. These models will now be discussed highlighting any perceived drawbacks with the models.

Dennis et al. (1988) proposed a research model (figure 1) representing a group process and outcomes using an Electronic Meeting System (EMS).

![Research model of group process and outcomes using an EMS (Dennis et al, 1988)](image)
The researchers view their model an integration of the many “micro models” developed by individual research groups for their own programmes of work. This is also the model adopted by Nunamaker et al. (1989). In the model, “group” variables include individual member characteristics, namely, group size, history, formal/informal, ongoing/one time, experience and cohesiveness. “Task” variables are the type of task, rational/political and degree of complexity. “Context” refers to incentives and reward systems, organizational culture and the environment, while “EMS” is composed of variables such as the presence or absence of EMS tools and the environmental design. “Process” variables relate to the degree of structure, the number of sessions, degree of anonymity, leadership, participation, conflict and non-task behaviour. “Outcome” variables include satisfaction with the process and the outcomes themselves, in particular, outcome quality, time required, number of alternatives generated, number of comments and degree of consensus.

One major drawback of the model is that it is limited to EMS. Furthermore, the model is lacking in group variables such as power and status relationships which are known to influence greatly the group process and outcomes. Characteristics of individual group members are given only a passing reference. There appears to be no recognition that meetings may occur in series and that participation in one meeting affects group members’ participation in subsequent meetings. The authors acknowledge that their framework is necessarily incomplete; “there are far more factors affecting meetings than can be represented in one diagram”.

Connolly et al. (1990) use McGrath’s (1984) model of a group process illustrated in figure 2. McGrath (1984) suggests that four major classes of inputs set the conditions under which group interaction takes place. These inputs are:

1. properties of group members, for example, biological, social and psychological;
2. properties of the standing group (the group structure);
3. properties of the task and situation, for example, patterned relations among environmental inputs;
4. properties of the surrounding environment.
Each of the major inputs work singly as well as in combination with one another. The group interaction is affected by these input variables, but is also patterned by forces internal to the interaction process itself.

McGrath (1984) proposes that a group interaction is characterized by two major factors, namely, individual people and the environment in which they are embedded. The relevant "properties of the individuals" include biographical and demographic characteristics, for instance, age, gender, personality dispositions, beliefs, attitudes, values, moods, feelings, states of mind, drives, needs, motives, goals and expectations. "Properties of the environment" include the conditions of the general physical environment such as noise, heating and lighting, and the social environment such as inter-group conflict, loyalty and alienation. McGrath (1984) stresses that both these classes have numerous if not an infinite number of variables. When people become interrelated as in a group, patterned relationships develop such as in terms of status and power, and these constitute the standing group structure. Environmental properties are also patterned and a particular set of environmental demands, constraints and opportunities combine to form a task and situation. Group interaction involves the group carrying out a task and any group interaction can be characterized in terms of the task. In the model, the "behaviour setting" represents an interaction between the group as a structured entity and the "task/situation" as a set of
requirements, demands, opportunities, possibilities and constraints. The framework recognizes that properties of the individuals and the environment influence directly the “behaviour setting”. These five identified major factors form the inputs for the “group interaction process” which refers to the processes that take place when group members interact in behaviour settings that carry task structures and environmental effects (McGrath, 1984). McGrath (1984) sees the group interaction process as the central feature as the essence of the group lies in the interaction of its members. Such activity can be described in terms of many processes, including the level and rate of interaction, distribution of participation and the extent of member involvement. The group interaction process feeds back and influences input variables. Individuals are often changed in some way as a result of being members of a group, for example, their attitudes towards other members may be affected. Group interaction can also alter the structure of the standing group, such as changing the pattern of attraction among members.

McGrath’s (1984) model is a comprehensive illustration of a group process, but it cannot be used as it stands in order to direct GDSS research as it lacks variables associated with GDSS. Furthermore, output variables are not addressed; hence there is a need to supplement the model with outputs from the group interaction when the group uses some form of GDSS.

Martz et al. (1992) devised a research model, illustrated in figure 3, for comparing the results achieved from an electronic work group infrastructure with those from a corresponding manually supported group interaction.
Chapter Four: Research and Literature Review

"Work group" variables include group size, cohesiveness, group structure and group history. The metavariable "work group task" contains the variables task size, task difficulty, co-operation requirements and task type. The "organizational environment" is characterized by variables such as the economic well-being of the company, the position of the company in the industry and the policies and procedures of the company. "Work group infrastructure" pertains to the environment in which groups hold their meetings, that is, whether it is manual or electronic. "Meeting process" refers to the mapping of the group's activities to the EMS tools, while "outcomes" are concerned with the group's cumulative performance over multiple levels, for example, over the length of a meeting or project and at different sites. Outcomes variables include the number and length of meetings, administration costs and man-hour dollar costs.

There are four principal drawbacks to the model proposed by Martz et al. (1992). Firstly, Martz et al. (1992) refer to non-electronic GDSS only once, stating that the work group infrastructure or the environment in which the work group holds their meetings can be either manual or electronic. When discussing the meeting process, the authors talk only of the EMS tools and no mention is made of non-electronic meeting tools. Secondly, the characteristics of the individual members making up the group are not considered. Although these are difficult to measure and almost
impossible to control, they are seen by many researchers as an important influence upon the process. Thirdly, no process variables are proposed in their model; recognition of the process is restricted to a description of meeting process mapping. Lastly, few output variables are suggested. Martz et al. (1992) state that the “outcome construct relies almost exclusively on the research question to identify its underlying variables”. In this particular study by Martz et al. (1992), the outcome construct focuses purely on five quantitative measures of performance with no consideration of qualitative measures of performance and outcomes.

The previous models were concerned with GDSS. Three studies reviewed in section 4.3 were concerned with DSS and the models used by researchers are presented below.

Sanders and Courtney (1985) conceive their model of DSS use to be composed of three classes of input variables, namely, user demographic, task environment and those associated with implementing DSS use. DSS success is assessed according to user satisfaction with the system.

Sainfort et al. (1990) describe a model of the problem-solving process which was used to structure the evaluation of DSS. They propose that behavioural, situational and contextual variables set the initial conditions of a problem-solving process, intervene during the problem-solving process and consequently influence the nature of the outcomes. More specifically, structural variables that may influence the episode of problem solving include the predispositions of individuals for problem solving, the characteristics of the problem itself, for example, its severity and occurrence, pressures from the environment, incentives in the situation and possible rules that may constrain individual behaviours. While process variables focus on evaluating the phases of the problem solving process, namely, problem structuring, generation and evaluation of alternatives, choice of solution and implementation, outcome variables are restricted to a measure of how the use of a DSS increases the likelihood of solving problems.

Guimaraes et al. (1992) presented a model of the determinants of DSS success. The
model consists of four sets of variables which can be viewed as input variables, namely, "characteristics of the implementation process" such as top management support, user training and user involvement, "characteristics of the task" such as task structure and certainty, task difficulty, variability and independence, "characteristics of the decision makers" such as organizational level and DSS experience and "characteristics of the DSS" such as phase supported, level of managerial activity and source of information input. These variables interact to produce user involvement with the system resulting in two sets of output variables, namely, user satisfaction and perceptions of DSS benefits.

The main drawback with the above three models is that they are concerned specifically with an individual's use of a DSS and do not include variables associated with a group's use of a decision aid.

In summary, this section examined five models used by researchers in the studies reviewed in sections 4.1 to 4.3. Many of the models include variables concerned with the task, the group (where appropriate), the environmental context and features of the decision aid. The principal disadvantages with these models are a lack of individual member characteristic variables, process variables and outcome variables and also the concentration on electronically based, rather than manually based, GDSS.

4.6 Other GDSS research frameworks

A number of other frameworks which are relevant to the current work can be found in the literature and these are reviewed below.

Gorry and Scott Morton (1971) developed a framework of managerial activities as a way of viewing MIS. They felt that an understanding of managerial activities is a prerequisite for effective MIS design and implementation. The framework is based on two main variables: Simon's (1960) classification of decisions according to the degree of structure underlying the decision issue which specifies how a manager deals with the problem and Anthony's (1965) classification of managerial activity according to purpose, namely strategic planning, management control and operational
control. Using these two variables, Gorry and Scott Morton (1971) produced a two-dimensional framework "within which to examine the purposes and problems of information systems activity". The main drawback of this framework is its limited scope. In a retrospective commentary to their original article, Gorry and Scott Morton (1989) acknowledge a number of limitations of their framework: it fails to recognize the complexities of the management setting, in particular, the existence of multiple goals, different organizational cultures and varying personal styles. They also accept that they had ignored the collective nature of many problem solving activities.

Mason and Mitroff (1973) proposed a programme for MIS research based on five key variables, namely, a person's psychological type, the problem, the organizational context, the evidence and its mode of presentation. Mason and Mitroff (1973) present a taxonomy of states for each of the five variables. For two of the key variables, class of problem and organizational context or organizational class of problem, Mason and Mitroff (1973) use the two methods of classifications proposed by Gorry and Scott Morton (1971). As with Gorry and Scott Morton's (1971) framework, Mason and Mitroff's (1973) programme of research is also limited in scope. The authors recognized the limited nature of their model by stating that they have captured "only the most important variables" and that they "could add a large number of additional variables". Furthermore, Mason and Mitroff (1973) have only addressed context or input variables and propose neither process nor outcome variables.

Ives et al. (1980) reviewed five MIS frameworks (including the two described above) and found they all depicted a rather narrow representation of the MIS field. In response, they developed a more comprehensive framework for categorizing previous research and for suggesting possible future research. The framework includes five classes of environmental variables: external, organizational, user, IS development and the resources necessary for IS operations. The second component of the model is the process comprising interactions between the information system and the five environmental classes. The process variables represent measures of these interactions and consist of three classes: development, operations and use. The final component of the model is the information subsystem which is the output of the development
process. In this model the authors did not produce a definitive list of variables, preferring to restrict themselves to offering only examples of possible variables, thereby leaving unresolved the problem as to which variables researchers should consider.

Pinsonneault and Kraemer (1989) carried out a review of many of the studies which assessed the impact of technological support on group processes and outcomes. From this review and also from the literature in group psychology and organization behaviour, they developed a framework of a group process, shown in figure 4.

![Figure 4](image)

**Figure 4** The Pinsonneault and Kraemer (1989) framework

Each of the four main components of this framework is subdivided into what Gray et al. (1990) term “metavariables” and each metavariable is further subdivided into variables. As an example, the framework component “contextual variables” is subdivided into the metavariables personnel factors, situational factors, group structure, technological support and task characteristics, while the metavariable personnel factors is composed of the variables attitude, abilities, individual motives and background. The “group process variables” consist of decisional, communication, and interpersonal characteristics and the structure imposed by the GDSS. “Task related outcomes” are subdivided into characteristics of the decision, implementation of the decision and the attitude of group members towards the decision. “Group related outcomes” refer to the attitude of the group towards the process. Gray et al. (1990) further subdivided the variables of the framework into what they termed indicators, for example, the variable “background of group members” is subdivided into the indicators previous group experience, education, age and computer ability.
The framework of Pinsonneault and Kraemer (1989) is valuable to the study of electronically-based GDSS. However, there are several main drawbacks to their framework. It is concerned solely with electronically based GDSS and focuses on single and isolated "electronic" meetings. The meeting descriptions are weak, there is no mention of the phases of decision-making and their influence on group process activities and the framework fails to recognize the broader, more long term but sometimes less tangible outcomes of group work.

In summary, the models of Gorry and Scott Morton (1971), Mason and Mitroff (1973) and Ives et al. (1980) are concerned with MIS and so lack variables associated with the group. Although the framework of Pinsonneault and Kraemer (1989) includes group variables it was found to be deficient in other areas and focussed particularly on the use of electronically based GDSS.

### 4.7 Other relevant models

The frameworks reviewed in sections 4.5 and 4.6 are concerned with modelling either a group's or an individual's use of a decision aid. There are several models which can be identified in the literature as representing a variety of organizational and group aspects. These more empirical models of group and organizational processes are important in developing the framework of the current work, as described in detail in Appendix One. These models will now be examined.

James and Jones (1976) designed a model to illustrate organizational functioning. The main components of the model include the external environment, the organization, its subsystems, groups and individual characteristics. The model is represented as a process with situational variables providing input to intervening variables which interact with individual characteristics to produce individual behaviours. They elaborate on the situational components of the model to produce a list of approximately 40 relevant variables, including context, physical environment, structure, systems values, systems norms and process.

Radford (1978) discusses the work of Duncan (1972) who considered that the total
environment of an organization can be thought of as a system one level higher than the organization itself. In this higher level system, the organizations are seen as the components while in lower levels of the hierarchy, the components of an organization can be regarded as systems in their own right operating in the organizational environment of which they are part.

Kerr (1979) defines an input to a model of group performance as any variable or condition present at the outset of the group’s performance episode. Kerr divides these inputs into three categories as shown in his model in figure 5.

![Figure 5 Model of group performance (Kerr, 1979)](image)

Kerr (1979) defines “environmental variables” as “those characteristics of the group’s environment which are likely to influence group outcomes, for instance, the authority and reward structures of the organization within which the group operates”, while “group inputs” refer to characteristics of the group, such as its size, which can be expected to influence group outcomes. “Individual inputs” reflect the characteristics of individual group members, such as member personalities and intelligence. “Group outcomes” refer to any result or consequence of the “group interaction process”. Kerr (1979) classifies these into task performance variables such as quantity or quality of performance, personal variables such as participant’s satisfaction, or social interaction variables such as group cohesiveness. Kerr (1979) stresses the need for greater attention to the process itself and for an improved understanding of the nature of transforming the inputs to outputs.

Scott (1981) gives a simple model of the basic characteristics of an organization,
shown in figure 6.

"Social structure" refers to patterned or regularized aspects of the relationships which exist among the participants of an organization. Scott (1981) divides social structure into two components: normative structure which is concerned with values, norms and role expectations, while behavioural structure focuses on actual behaviour rather than prescriptions. “Goals” are conceptions of desired ends which the participants attempt to effect through task activities. “Participants” refer to those individuals who make a contribution to the organization, while the term “technology” focuses on the organization as a place where some type of work is undertaken. Scott (1981) regards the environment as “an indispensable ingredient in any organizational model”.

Mitchell (1982) presents a frame of reference for the study of small groups, illustrated in figure 7.
Each of the categories in the model consists of a number of variables. “Personal characteristics” refers to attitudes, ability, personality and background while “group structure” includes influence, attraction, status and communication. The category “situational characteristics” is composed of variables such as space, task type, group size and rewards. The variables of “group process” include who says what to whom, why and with what result. “Effects on individuals” comprises attitudes, such as job satisfaction and knowledge and “effects on group” includes new norms or interaction patterns. “Effects on environment” include productivity.

In summary, many similarities exist between the models reviewed in this section and they propose a large number of variables important in the study of organizations and groups. The functioning of an organization is generally modelled as a hierarchy of levels influenced by external environmental variables while the organization itself provides an environment in which subsystems such as groups and individuals operate and interact. In the study of groups, features of the individuals, group and situation together characterize and shape the group process resulting in individual, group and task outcomes.

**Review**

Sections 4.5 to 4.7 have reviewed models which represent both a group’s and an
individual’s use of a DSS and various factors associated with group and organizational functioning. Many features of these models were used to develop the main structure of the framework in this thesis.

4.8 Evaluation of GDSS

This section discusses the need for the evaluation of GDSS, methods of evaluating GDSS and then examines, in particular, the use of questionnaires in GDSS evaluation.

4.8.1 The need to evaluate GDSS

The rationale for evaluating GDSS use is contingent upon the evaluator's perspective. From a practitioner’s point of view, evaluation of GDSS allows an assessment of the benefits of using GDSS. Researchers wish to assess the effects of input variables, including the features of the GDSS, on the group process and outcomes in order to study the minutiae of how GDSS alter the group decision-making process.

Eden and Ackermann (in press) suggest three reasons for evaluating GDSS.

1. There is a desire to encourage competition between GDSS so that the best is determined and recommended to potential users.
2. It allows the strengths and weaknesses of each GDSS to be recognized in relation to its claimed strengths.
3. It helps in the development of GDSS.

The first reason is valid in that evaluation of GDSS in different situations would identify the most appropriate system to be selected for use under certain conditions. The latter two reasons are concerned with evaluating whether GDSS support the group in the manner intended and may also highlight areas for improving the process of group support.

4.8.2 Methods of evaluating GDSS

Keen and Scott Morton (1978) propose eight methods for evaluating DSS by
assessing.

1. Decision outputs.
2. Changes in the decision process.
3. Changes in people's concepts of the decision process.
4. Procedural changes.
5. Cost/benefit analysis.
6. Service measures.
7. Managers' assessments of the system's value.
8. Anecdotal evidence.

Each item of this comprehensive list will be examined in turn.

1. Decision outputs
Keen and Scott Morton (1978) suggest that the ideal measure for evaluating a system that aims to produce better decisions is to measure the results of implementing the decisions reached. However, it is naïve to expect that the use of a DSS results directly in better decisions and it is difficult to evaluate what is a "better decision". It is difficult to measure and evaluate the results of the decision outputs, because GDSS are frequently used for strategic decisions which, when implemented, have far-reaching consequences in terms of both the number of affected events and the time in which these changes occur. Furthermore, it would be necessary to try to quantify the effects of the decision and unless a similar decision has been made previously, which defies the definition of a strategic decision, there is no quantifiable sum against which to compare the result.

2. Changes in the decision process
The argument for assessing the way decisions are made is that better decisions could be reached if the process for decision-making is improved. There is no proof that the new process of arriving at a decision is better; the test is one of plausibility, that is, do the system users accept that this is a more effective process than the former decision making process (Keen and Scott Morton, 1978)? Again this assessment requires the measurement of the quality of the resulting decision.
3. Changes in people's concepts of the decision process
One reason for using DSS is to extend a person's bounded rationality for dealing with complex tasks. DSS are seen partly as systems for aiding learning in that better decision-making should result from better understanding, richer insights and more extensive assessment and synthesis of data. The use of DSS focuses the efforts of decision makers on the need to improve a decision. This process often clarifies the underlying structure of the problem and can be in itself a "rewarding intellectual effort". Keen and Scott Morton (1978) stress the need for this learning to be monitored and evaluated and suggest that, although learning is a difficult concept to measure, it is important that researchers should attempt to capture what is occurring if only through the use of questionnaires. Managers are sensitive to this question and can often give a reasonable assessment of how much the use of a DSS has helped them understand a decision or its context.

4. Procedural changes
This addresses those activities within the decision process that are in some sense physical, such as the mechanical procedures and the use of resources such as people, machines and paper as opposed to the mental components of the process such as information, analysis and learning. Physical procedural changes are concerned with the efficiency of the process as opposed to its effectiveness and have the advantage of being observable and hence more easily assessed. Examples of physical procedural changes include a reduction in decision-making time, a decrease in the amount of clerical support and a reduction in the amount of time and money spent on printing reports by circulating them using the computer. Assessment of procedural changes may be more appropriate for DSS used to support structured tasks. Although decision-making may be shown to be more efficient, this does not necessarily imply a consequent improvement in the quality of decisions made.

5. Cost/benefit analysis
All the changes examined in items 1 to 4 have involved costs as well as benefits. Some costs are tangible and quantifiable, for instance salaries, clerical support and computer facilities, other costs are less quantifiable, such as the time and commitment of managers and some costs are hidden, such as the psychological cost of change.
Cost/benefit analysis involves quantifying the benefits gained from the decision made using the system and is most meaningful if intangible gains and losses, such as managers’ assessments of the system, can also be quantified in some way. Cost/benefit analysis is of relevance to item 6 which involves assessing the objective aspects of the service and also to items 7 and 8 which aim to gain managers’ assessments of the system.

6. Service measures
This entails defining a DSS as a service rather than a product and implies using broad criteria for measuring the quality of the system from the users’ perspective, for example, the responsiveness of the system, the availability and convenience of access and the reliability and quality of the system’s support, such as documentation and training. However, even if assessment using such measures indicates a system of high quality, it does not necessarily imply that the DSS is perceived as useful by decision-making managers.

7. Managers’ assessment of the system’s value
An effective way of quantifying benefits is to ask the managers. As discussed in item 3, managers often have a shrewd sense of the worth of a resource or service and this information can be gathered through questionnaires or interviews.

8. Anecdotal evidence
Use of DSS often stimulates unexpected benefits or problems. Keen and Scott Morton (1978) suggest that it is useful to supplement formal evaluation with anecdotal evidence, such as insights, examples and opinions expressed by users.

Items 2, 3, 5, 7 and 8 entail asking users for their perceptions of both the system’s tangible and intangible benefits and for their attitudes to the resulting decision outputs. Over half of the methods suggested by Keen and Scott Morton (1978) for evaluating DSS involve the elicitation of users’ subjective information and feelings regarding the system. However, the clarity or ease of operationalization of the criteria suggested above for assessing the quality and quantity of group output may vary widely (Kerr, 1979).
Eden (1992a) asserts that there are only three viable approaches to assessing the success of a GDSS. These are as follows.

1. Compare the system with the theory which determined the design of the system.
2. Use controlled laboratory experiments involving contrived groups and problems in order to understand the micro characteristics of the theories underlying the design of the GDSS.
3. Ask the client to explain what happened when they used the GDSS and to compare this with the conceptual framework.

All three methods are concerned with evaluating the system by comparing it to the theories used in the design of the system. Hence, these methods evaluate the system from the designer's point of view.

From the review of research (sections 4.1 to 4.3), it was seen that GDSS evaluation can be achieved by measuring a variety of variables using two main methods of data collection. These methods are content coding of the computer files and the group's interaction in order to micro-analyze the process and the use of a post-process questionnaire given to group members to assess such variables as their satisfaction with the resulting decisions and perceived spread of participation.

Much of the work reviewed was concerned with studying GDSS which used computers as part of the support and this facilitates the content coding of the group process. In GDSS environments where computers are either absent or play a secondary role to the facilitator, an alternative to content coding of computer files is to video the group process and then code the process according to Bale's (1950) Interaction Process Analysis (IPA). Bale's (1950) IPA is a method of classifying direct face to face interaction in small groups into 12 major interaction categories such as questions, answers, positive and negative reactions, task problems and socio-emotional problems. However, such micro-analysis is both time consuming and labour intensive and can make it difficult to maintain meeting confidentiality. For many researchers and practitioners, the questionnaire is the only feasible alternative method for assessing a group's use of GDSS.
4.8.3 Use of questionnaires in GDSS evaluation

The research review has highlighted the fact that post-process questionnaires are frequently used to elicit information from users about various aspects of GDSS use (sections 4.1 to 4.3). A number of different GDSS practitioners use questionnaires to gather information from users of their systems. A questionnaire used to assess Decision Conferencing focuses on McCartt and Rohrbaugh's (1989) criteria of Competing Values Approach (CVA) and asked participants to compare a Decision Conference with a conventional meeting. Approximately equal numbers of questions focussed on aspects of the process and of the outcomes. A second questionnaire for Decision Conferencing has been used at the Rockefeller Institute of Government at the State University of New York with many of the questions again directed by using the CVA. Researchers at the University of Arizona have used a number of questionnaires to assess participants' use of their facilities. These questionnaires vary in length but a number are relatively long with over 30 questions.

Post-process questionnaires have been used in studies researching other aspects of group-working. For example, Ridgeway (1982) investigated the relationship between perceived status and focus of motivation which ranges from self- to group-oriented motivation. A post-experimental questionnaire asked members for their perceptions of group structure by ranking group members on their level of influence, competence, likability of the group and whether any member emerged as group leader. In a study of small groups working on three tasks, Green and Taber (1980) asked subjects to complete a post-experimental questionnaire to assess topics such as personal task participation, negative socio-emotional behaviour, solution satisfaction, decision scheme satisfaction and informal leadership.

4.8.4 Disadvantages of questionnaires for evaluation

Researchers have debated the use of questionnaires in GDSS research. Eden (1992b) offers the following three arguments against the use of questionnaires.
1. Eden's (1992b) first argument is that clients rarely cooperate in completing forms. He states that "many of the UK GDSS were designed to support "elites" and these groups are characteristically difficult to treat as research subjects". However, "elites" are probably the most frequent users of GDSS and therefore, these are probably the only people who can be approached to use as research subjects. In order to assess the success of GDSS, Eden (1992b) advocates as one approach asking clients to explain what happened while they used the GDSS and to compare their comments with the conceptual framework of the designer. This approach necessarily involves using participants as research subjects to some extent and thus his concerns regarding the use of "elites" as research subjects is unjustified.

2. Eden's (1992b) second argument is that strategic decisions are often made in groups of a composition which changes over time. This poses the problem of knowing when to administer the questionnaire. Furthermore, group members' recollections of events and general feelings towards the GDSS may be affected by the passage of time (Ackermann, 1993; French, 1993). Participants often experience a feeling of euphoria immediately after the meeting and may consequently rate its success higher than at a later stage when they have had time to identify the problems of implementing the decisions reached and when their views of the meeting have been changed by discussions with others (Ackermann, 1993). French (1993) found from one personal experience that at the end of a meeting involving participants from different organizations, a decision was reached to which all parties agreed and were pleased with the meeting outcomes. However, a year later the feelings of one party towards the decisions changed; they no longer agreed with the decision and desired a different outcome.

These problems of changes in feelings and knowing when to evaluate GDSS arise when using any method of GDSS evaluation. For example, at what point in time should the effects of implementing a decision be evaluated in order to analyze whether the decision was better as a result of using the GDSS?

3. Eden's (1992b) third argument is that "GDSS methods are very rich" and to capture this richness of the process it is necessary to use methods where clients are
allowed free expression to relate their experiences. He argues that "valuable insights are gained from unsolicited comments". However, if the questionnaire has been developed correctly, that is, from an in-depth review of the subject, by talking to experts in the field and by pre-testing, the questionnaire should cover those topics likely to arise in a discussion of GDSS use. An appropriately-validated questionnaire will have been assessed for content validity. Furthermore, open-ended questions can be included in the final questionnaire to allow respondents a degree of free expression. Evaluating the success of GDSS using interviews will involve asking questions similar in content to those included in the questionnaire. The only true value of an interview is the opportunity it poses researchers for probing certain areas of interest. The disadvantage is the depth of interaction required from participants and the time required by researchers to administer interviews and to analyze the results.

Many real groups use GDSS on confidential issues. Clients are only prepared to talk about their experiences once a feeling of trust has been nurtured after a period of time. As this trust develops the client is prepared to talk about their use of the GDSS. However, Eden (1992a) admits that these opportunities are only available to the facilitator or designer of the system with whom the group has prolonged contact. This is where the advantages of the questionnaire arises as it can be administered by staff external to the meeting, thereby, maintaining confidentiality and results can be obtained free from the bias engendered by the facilitator's presence at the interview.

### 4.8.5 Advantages of questionnaires for evaluation

The use of questionnaires has a number of advantages. They are relatively straightforward to administer and to analyze the results and they can elicit useful information. They can be administered by people having little in-depth knowledge and experience of research methods and the results gained are not susceptible to observer and rater bias. The researcher does not need to be present to administer the questionnaire which maintains the confidentiality of issues under discussion and completion requires a relatively short time commitment from participants. Questionnaires are effective at measuring a person's attitudes and it is users' attitudes towards the system which researchers principally wish to evaluate. As Ives et al.
(1983) stress, a good system viewed as a poor system is a poor system and furthermore, satisfaction with the system leads to use rather than use leading to satisfaction.

4.8.6 Target group for questionnaire

Eden (1992b) believes the choice of evaluation technique is dependent on both the topic and the research subjects. The topic may be sensitive and confidential while subjects may have limited communication skills or be of top management status. Eden (1992b) discusses the comments of Walker (1985) who says, that as a result of these differences in research subjects, the use of standard assessment techniques would result in subjects having to respond to questions which to one group of subjects may be “mystifying” and to another “humiliating”. Hence, there is a need to specify for whom the questionnaire is intended. A review of articles in OR Insight and OR Newsletters reveals that “soft OR” practitioners are using GDSS and hybrid methods with a variety of groups such as community groups for whom the questionnaire in this research would be inappropriate. For example, Vangen (1993) used cognitive mapping with the Strathclyde Poverty Alliance, a local community group which aims to combat poverty and Thunhurst et al. (1992) used Strategic Choice with the Thurnscoe Tenants Housing Cooperative. Not only is the wording of the questions in this research inappropriate for such groups, but the members may evaluate GDSS use according to criteria different from those used by managers.

Eden and Ackermann (in press) consider that different stakeholders will evaluate GDSS according to different criteria. For example, the developer may want the GDSS to be unique and distinct from others and offer transferability of the system, while users of the system may be subdivided into the sponsor who wants good decisions and value for money from the system and those actually using the system who want the experience to be enjoyable and effective. There is a repertoire of evaluation criteria some of which are more appropriate for some stakeholders than others.

It is important to stress for whom the questionnaire is intended. In this thesis the questionnaire has been designed for use by managers.
Review

This section has examined the need for and methods of evaluating GDSS use. The discussion then focused on the use of questionnaires, examining their advantages and disadvantages in GDSS evaluation. It is concluded that questionnaires are an acceptable method of evaluating use of GDSS, but that it is imperative to state for whom the questionnaire is intended.

4.9 Validity and reliability

In Chapter Three a discussion was presented on the importance of validating measuring instruments. Validation was defined as the process whereby tests are carried out on the measuring instrument to check that it measures what it is supposed to measure and that it does so accurately and reliably. The following section examines the different types of validity and reliability and how to test for these in a measuring instrument.

4.9.1 Validity

The validity of a measuring instrument is its ability to reflect "true" differences either among individuals at a point in time or within a single individual over time (Green et al., 1988). Validity indicates the degree to which an instrument measures the construct under investigation (Bohrnstedt, 1970), where a construct is defined as a concept but with the added meaning of having been deliberately and consciously invented or adapted for a special scientific purpose (Kerlinger, 1973). The construct of interest in this research is the process and outcomes of GDSS supported group meetings. The use of the term construct in this context should not be confused with the term construct validity.

Many types of validity have been described (Finlay and Wilson, 1992). However, there are three main types of validity which are most commonly used to validate measuring instruments, namely content, criterion-related and construct validity; the latter two consisting of a number of subcases of validities. These validities will now be discussed in turn.
1. Content validity

Content validity is typically the first test of validity to be performed. It is concerned with the representativeness or sampling adequacy of the items in the measuring instrument or test to the subject under study (Kerlinger, 1973). As the name suggests, content validity concerns the content of the scale, that is, the substance, matter and topics as they relate to the characteristic that is being measured (Green et al., 1988). Bailey and Pearson (1983) view a measuring instrument as having content validity if all aspects of the attribute being measured are observed in the instrument.

To produce a content valid instrument Brown (1983) suggests that it is desirable to assemble large collections of items from which to draw random samples of items. To do this it is necessary firstly to specify the domain of content of the construct under investigation. This should contain both a broad definition and detailed subcategories (Brown, 1983). As the test items must be a representative sample either of the universe of possible content or of the behaviour domain, it is imperative to select items in proportion to their emphasis or importance. This procedure is referred to as sampling from a domain of content (Bohrnstedt, 1970). A measuring instrument shows content validity to the degree that sampling from the domain of content is representative of all strata and to the degree that items constructed tap the subtleties of meaning within each of the strata (Bohrnstedt, 1970).

In practice it is very difficult to draw random samples of items from a universe of content as such universes exist only theoretically and are virtually infinite. Therefore, if it is not possible to satisfy strictly the definition of content validity, how can a reasonable degree of content validity be achieved? The solution normally adopted is to judge the test on its perceived content validity (Brown, 1983). Each item in the test can be judged for its presumed relevance to the property being measured by following a logical and rational process of comparing the test items to the content domain (Kerlinger, 1973). This is best done by an expert in the field (Brown, 1983). The instrument serves as a sample or representation of the content domain and from the results of this sample of items, inferences will be made about the whole domain (Kerlinger, 1973).
2. Criterion-related validity

Criterion-related validity of a measuring instrument is concerned with comparing the test or scale scores with one or more criteria known or believed to measure the attribute under study (Kerlinger, 1973). The nature and types of criterion predicted by the test scores give an indication of what construct the test measures.

To test for criterion-related validity, the researcher attempts to develop or obtain a criterion against which the scaling results can be matched (Green et al., 1988). It can be assessed by correlating a set of results gathered using the instrument under study with a second set, collected using another instrument administered at the same time or applied on a future testing occasion.

There are two dimensions to criterion-related validity known as concurrent and predictive validity.

a) Concurrent validity compares the results of the measure of the criteria using the measuring instrument with the actual criteria. To establish concurrent validity the test is given to the subjects, while at the same time an established test is used or a criteria known to measure the attribute under study is applied. The results from the measure under test are then compared with the established measures (Allen and Yen, 1979).

A method of concurrent validity which has been used frequently in the studies validating User Information Satisfaction (UIS) measures (see section 4.10) is to include in the measure global measures of satisfaction. These consist of two questions asking for overall satisfaction with the system and the system's output. These global measures are then used as the criteria values for comparing the scores from the UIS measure.

b) Predictive validity is concerned with whether the test measure can predict future scores (Brown, 1983). To establish predictive validity the test is given to subjects and after a period of time the criteria are then measured and the predictive test scores compared with the scores from the actual measures (Allen and Yen, 1979). Predictive validity is established by comparison with another “established” measure of the
attribute. In assessing predictive validity, the researcher may not be so interested in what the test measures but rather whether it is able to predict scores (Kerlinger, 1973).

Determining criteria for concurrent and predictive validity which are known to measure the attribute under study is often difficult. The degree of correlation between the test results and criteria scores increases or decreases one's confidence in the test as a measure of the purported trait (Brown, 1983).

3. Construct validity

The term construct validity is generally used to refer to the correspondence between a construct which is at an unobservable, conceptual level and a purported measure of it which is at an operational level (Peter, 1981). Alien and Yen (1979) define construct validity as the degree to which an instrument measures the theoretical construct or trait that it was designed to measure.

Tests for construct validity investigate what qualities a test measures by determining the degree to which certain explanatory concepts or constructs account for performance on the test and the variance in scores (Bohrnstedt, 1970). Churchill (1979) asks, “Are the variables which the instrument is measuring a measure of the trait or concept you wish to monitor?” The researcher is interested not only in whether the instrument works but also in the development of criteria that resolve the two theoretical questions as to why it works and what deductions can be made concerning the theory underlying the instrument (Green et al, 1988).

Construct validation is concerned not simply with validating the test but also with validating the theory behind the test (Kerlinger, 1973). Cronbach (1970) views construct validation as involving the three following steps.

1. Based on current theory about the trait and area of interest, constructs are suggested which may account for differences in performance.
2. From theory, hypotheses are derived about how the test scores should behave in different situations and with different people.
3. These predictions or hypotheses are tested by gathering data and then deciding
whether the theory does explain the difference in the data collected. If the predictions are supported, then construct validity is established (Brown, 1983; Cronbach, 1970).

There are several ways of assessing the construct validity of a test. Three commonly used methods are to test the measuring instrument for convergent, discriminant and factorial validity. A lesser used method is that of congruent validity. These methods are now discussed.

a) Convergent validity is concerned with the degree to which the results from different methods of measuring the same trait converge. It is demonstrated by high correlations between scores on tests measuring the same trait by different methods, such as written as opposed to oral examination (Kerlinger, 1973).

b) Discriminant validity is the degree to which scores from tests which are designed to measure different traits should not be highly correlated (Brown, 1983) and is established by measuring different traits using the same method. A low correlation between the resulting scores shows that the tests can discriminate between the different traits (Allen and Yen, 1979). To test for discriminant validity it is necessary to measure more than one trait.

The multitrait-multimethod (MTMM) technique described by Campbell and Fiske (1959) can be used to examine both the discriminant and the convergent validity of a test and to estimate the relative contributions of trait and method variance to the test results. MTMM analyses can be performed when two or more traits are measured by two or more methods. The aim is to use methods which are maximally different from one another, for example, a questionnaire and an interview. The resulting MTMM matrix presents all of the intercorrelations resulting when each of several traits is measured by each of several methods. An MTMM analysis separates the effects of the trait the test is measuring from the method of measurement. The technique is based on the premise that in research a particular construct should be measurable by at least two different methods, otherwise the researcher has no way of knowing whether the trait is anything other than an artefact of the measurement procedure.
c) Factorial validity is established by carrying out factor analysis. Kerlinger (1973) views this as one of the preferred methods of testing for construct validity. It is a statistical method for determining the nature and number of factors underlying the test items which account for the intercorrelation among test items. It establishes the proportion of variance in test scores accounted for by these factors (Brown, 1983).

There are several factor analysis techniques, but the most commonly used is called Principal Components Factor Analysis, which extracts factors in turn according to the proportion of variance in scores accounted by that factor. The first extracted factor accounts for the most variance with each succeeding factor accounting for progressively less. There are as many factors extracted as there are variables. Factor analysis identifies which factors determine performance on a test and thus can used as a means of summarizing and reducing data.

However, there are some problems associated with factor analysis. Kerlinger (1973) found that the ratio of sample size to the number of scales (a scale is equivalent to one item on the questionnaire) has an important effect on the results. He believes that this ratio should have a minimum value of 10:1 (Ives, Olson and Baroudi, 1983). Furthermore, in order to carry out factor analysis the variables must be measured according to the same scale.

d) Congruent validity is concerned with correlating the scores on the new test with scores on an established test measuring the same construct. This is a weaker validity test for construct validity and is rarely carried out as there is no reason to design a new test if one already exists.

In summary, as construct validity assesses the degree of correspondence between constructs and their underlying measures, it is a necessary condition for theory development and testing (Peter, 1981). To establish construct validity of a measuring instrument entails investigating a number of subcases of validity: convergent, discriminant, factorial and congruent were discussed.
Review

Three main types of validity have been discussed, namely, content, criterion-related and construct validity. If criterion-related validity shows that the test distinguishes between individuals measuring high and low in a trait, construct validity would determine why. Construct validity and empirical scientific study are closely allied. It is not simply a question of validating a test or showing that a test distinguishes between low and high scorers (Kerlinger, 1973); it is necessary to try to validate the theory behind it. The researcher is interested in why the test distinguishes between them.

The choice of which types of validity it is appropriate to investigate in the current research is discussed in Chapter Five.

4.9.2 Reliability

Reliability is concerned with the consistency of test results applied to groups of individuals or to the same individual at different times (Green et al., 1988). It is the degree to which measures are free from error and therefore yield consistent results (Peter, 1979). Reliability is dependent on the stability of the characteristic over time.

Brown (1983) discusses three basic methods for assessing the reliability of a measurement scale, namely, test-retest, parallel or alternate forms and internal consistency. The difference between these methods is based on the measure with which the scale is to be correlated with in order to compute the reliability coefficient. The reliability coefficient is concerned with the correlation between scores from two administrations of a test to the same people. The methods will now be discussed.

1. Test-retest reliability

This is concerned with the resulting stability in scores when a single test instrument is applied to the same subject at two different points in time. The correlation of the resulting two sets of scores assesses the extent to which repeated applications of the test give the same results.
One problem associated with test-retest is that there is a potential for carry-over effects between testings when the first testing may influence and contaminate the second testing by respondents changing their attitudes or having more information available to them (Brown, 1983).

2. Parallel or alternate forms reliability

This is concerned with the equivalence of test items. Parallel or alternate form reliability is the correlation between observed scores on two parallel or similar instruments measuring the same construct when applied to the same subjects. Each scale is designed to be similar in content to the other, cover the same content, use the same types of item and to be of equal difficulty. To determine parallel forms reliability, one form (Form A) of the test would be administered and then with a minimum time lag the second form (Form B) would be administered. To counterbalance the effects due to order of administration, half the group may be administered form A followed by form B and the other half be administered form B followed by form A. The resulting scores from the 2 administrations are then correlated to obtain a reliability coefficient.

Based on the assumption that any test contains only a sample of all possible items, a number of parallel forms of the test can be constructed. However, it is difficult both to develop substantially equivalent but parallel measures and to verify that the two tests are parallel (Allen and Yen, 1979). Parallel forms reliability differs from convergent validity in that the tests are applied using the same method of administration.

It is possible to determine reliability by a combination of the two methods described above in order to assess the reliability coefficient of stability and equivalence. The procedure entails administering one test and allowing a period of time to pass before administering the second test. As with the parallel forms reliability, the method involves giving half the group form A followed by form B and the remaining half form B followed by form A. The resulting scores from the two administrations are then correlated to obtain a reliability coefficient.
3. Internal consistency

In certain cases, it is not possible to either repeat the test or administer an alternate test in which case an alternative method of assessing reliability is to calculate the internal consistency of the test. An analysis of the internal consistency of a test involves applying the measurement scale to subjects at one point in time and determines the degree to which subsets of items within the scale are then correlated (Brown, 1983). Internal consistency is related to reliability, in particular to the coefficient of equivalence, but it addresses a somewhat different question to reliability. It answers the question “do all items on the test measure the same characteristic or trait?” and focuses on the interrelationships between the various items comprising a test. If the scores on various items in a test correlate positively, the test can be said to be homogeneous, that is, it is internally consistent. Thus, these tests are concerned with internal consistency or homogeneity coefficients.

One method of testing for internal consistency is to apply the split-half technique in which the test is split into two equivalent halves and each half item score is correlated with the other half. However, this approach has the drawback that one half of the test may not be comparable to the other half.

A more efficient method is that of Cronbach's coefficient alpha (Cronbach, 1951) which compares the results obtained from each individual question with the total score. It determines the reliability coefficient for all possible ways of dividing a set of items into two halves and is the method most commonly used. The item-to-total correlations used to delete items are based on the items within one dimension of the test and the total score for that dimension. The total score for the construct would be secured by summing the total scores for the separate dimensions.

The reasoning behind the use of internal consistency as a measure of reliability is based on the domain sampling theory (see content validity, section 4.9.1). This theory holds that the purpose of any particular measurement is to estimate the score that would be obtained if all the items in the domain were used (Churchill, 1991). Brown (1983) explains that associated with each trait is a hypothetical domain of items that measure a particular construct. To develop a test, items are randomly sampled from
this domain and by repeated sampling it is possible to produce a number of parallel tests that measure the construct. Subjects are then measured using these tests and statistical tests carried out. Internal consistency adopts this process in one step.

When calculating Cronbach's alpha, a decision needs to be made about what is an acceptable level of reliability. Ideally, the test should be perfectly reliable, that is, have a reliability coefficient of 1, but in practice this standard is never attained (Brown, 1983). What constitutes an acceptable level of reliability varies with the nature of the test, how it is used and what type of reliability estimate is used. While the better tests available can achieve internal consistencies of 0.9, coefficients of 0.7 and above are generally acceptable where 0 represents no reliability and 1 represents complete reliability.

Internal consistency measures one quality of the measuring instrument and is not concerned with estimates of error caused by factors external to the instrument. It is inappropriate to use this test when the test cannot be divided into parts that are parallel or essentially equivalent or when the test does not have independent items that can be separated.

Brown (1983) suggests two factors which may influence the reliability of a test.
1. **Test length.** Longer tests are more reliable than shorter tests. This occurs because as the number of items in the test increases, the random measurement errors tend to cancel one another out.
2. **Range of scores.** Reliability coefficients are influenced by the variance of the test score distribution which is affected by the nature of the group tested. The more homogeneous the group, the lower the variability in scores and the lower the reliability coefficient.

**Review**

Three methods have been examined for estimating the reliability of a measuring instrument. The selection of an appropriate method for the current work is discussed in Chapter Five.
4.9.3 Sources of influence on scores

Any particular measurement or observation is only one of various possible measurements of those characteristics, that is each measurement is obtained under a unique set of conditions. Therefore, it is possible to obtain different measurement results under different conditions (Brown, 1983). There are three possible sources of such influence on scores.

1. Differences in scores reflect actual differences in the characteristic being measured.
2. Differences in scores are due to differences in characteristics which are not being measured.
3. Differences in scores are due more to chance or temporary influences.

The effect of items 2 and 3 above is to reduce the accuracy of measurement and hence they can be considered as sources of error. Sources of error generally fall into one of two categories.

1. Systematic errors which are produced by variables which have consistent effects but are irrelevant to the purpose of the test. The effects are consistent as they reflect broad, relatively permanent characteristics that differentiate between people. Stable characteristics will, therefore, have similar effects on several measures of a given trait. This has little effect on reliability but will effect validity (Brown, 1983).
2. Random errors reflect influences which are so specific to particular items or testing conditions or which occur in such a haphazard manner that they produce no identifiable systematic effects. The concept of reliability is concerned with the degree of influence of such measurement errors, but since validity of a measure is limited by its reliability, measurement errors also influence validity (Brown, 1983).

Review

If hypothesized relations among variables, or simply the values of variables are to be measured, researchers need to be certain that the instruments they are using to measure variables are valid and reliable (Bohrnstedt, 1970). Validity of a measuring
instrument is concerned with its ability to measure the construct under investigation
and to reflect true differences among subjects where a difference exists. Reliability is
concerned with the consistency of the results produced by the test (Brown, 1983) and
is a necessary but not a sufficient condition for validity (Churchill, 1991). However,
if a measure is valid it must also be reliable.

This section has discussed three main types of validity and reliability and has
considered how a measuring instrument can be tested for these qualities.

4.10 Measuring instrument validation

Several studies carried out in the field of MIS have involved developing and
validating instruments for measuring user satisfaction. This section looks at the
methods adopted in these studies for developing valid instruments and details the
tests for validity and reliability.

Bailey and Pearson's (1983) research was concerned with developing and testing a
questionnaire designed to measure computer user satisfaction. They hypothesized that
user satisfaction was related to the sum of a person's reaction to a set of factors and
the importance of each of these factors to the individual. They began devising their
questionnaire by reviewing relevant past studies from which they identified 36 factors
which affect computer user satisfaction. They then interviewed professionals to
discuss their experiences of end user satisfaction and asked them to rank the 36
factors in order of importance in relation to their own experiences of satisfaction and
to suggest any further factors of importance. As a result, three more factors were
added to the questionnaire.

1. **Reliability** of the questionnaire was tested by calculating the reliability coefficient
   of each factor.
2. **Content validity** of the questionnaire was claimed as a consequence of the
   procedure adopted for developing it.
3. **Predictive validity** was established by two methods. Firstly, the authors compared the questionnaire measures of satisfaction with self-assessed levels of satisfaction taken during the interview and secondly, they compared the self-assessed score with each individual factor score.

4. **Construct validity.** The authors state that construct validity is established if those factors which users state as important to perceived satisfaction are ranked as important in the measurement questionnaire. They compared the results from the questionnaires’ importance scale with the self-assessed rankings gathered earlier.

The researchers themselves did not use the resulting questionnaire, but they discuss its subsequent administration in five organizations. They found that several of the questions were irrelevant to a number of organizations and these were either deleted or the wording was changed to suit the particular situation in which the questionnaire was used. Consequently, the organizations were not using the questionnaire which had been tested for validity and reliability and were in fact using a partly unvalidated questionnaire.

The work of Ives *et al.* (1983) was an extension of the original work carried out by Pearson for his doctoral degree. Their main objective was to test further Pearson’s measure and to produce a shortened version of it. To achieve this they sent two mail questionnaires to the same people, one being Pearson’s questionnaire and the second being a four item measure of information satisfaction, called UIS4, devised by Ives *et al.* (1983).


2. **Content validity** The authors believed that the method Pearson used to generate his instrument established content validity. Ives *et al.* (1983) describe two types of “circumstantial evidence” for content validity, namely internal consistency and the correlation of the results from the questionnaire with other measures of the construct. Thus, they tested for content validity by comparing the results of each factor in the Pearson measure against the score achieved on the UIS4 measure. This method is not found in the literature as a normal means of establishing content validity (see section 4.9).  

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3. **Predictive validity** The questionnaire was tested for predictive validity by correlating the overall score from UIS4 with the overall score from Pearson's questionnaire.

4. **Construct validity** Two methods were used to establish construct validity. Firstly, they assumed that the total score from the Pearson instrument was valid and then compared the correlation between the total score with each single item score to assess the construct validity of each item. Secondly, Ives et al. (1983) carried out a factor analysis on the scores to identify the underlying structure of the overall measure.

Ives et al. (1983) used the results to reduce the questionnaire to a short-form measure of UIS consisting of 13 scales with two items per scale. They do not present a final version of the short form questionnaire.

Baroudi and Orlikowski (1988) carried out a study to examine the short form measure of UIS produced by Ives et al. (1983).

1. **Reliability** Baroudi and Orlikowski (1988) tested the measure for reliability by calculating Cronbach's alpha.

2. **Convergent validity** The measure was tested for convergent validity by comparing the responses from interviews with questionnaire responses.

3. **Construct validity** To test the measure for construct validity, the researchers examined the correlation between the score on each scale and the total UIS score. As in the previous study (Ives et al., 1983), the authors assume that the total score is valid and that each scale is construct valid to the extent that it correlates positively with the total score. Baroudi and Orlikowski (1988) also tested the measure for construct validity by carrying out factor analysis.

Doll and Torkzadeh (1988) wished to produce a measure of "end user computing satisfaction" designed for users who interact directly with a specific application. They reviewed the work of previous researchers to produce a 31-item questionnaire and then added seven further items and two global measures resulting in a 40-item questionnaire. The questionnaire items consisted of 5 point Likert scales. The authors then carried out structured interviews and the resulting qualitative comments were
compared with the responses to the questionnaire. In the pilot study, the following tests were performed.

1. **Criterion-related validity** The two global items measuring perceived overall satisfaction and success of application were assumed to be valid measures and the sum of these two items was used as a criterion scale. Each item on the measure was then correlated with the criterion scale to check for criterion-related validity. Items were eliminated from the measure if their correlation fell below a certain level. This resulted in an 18-item questionnaire.

2. **Construct validity**: The measure was tested for construct validity by comparing the correlation between the total scores with the individual item scores.

In the full survey, Doll and Torkzadeh (1988) carried out personal interviews and then administered the questionnaire in order to identify inconsistencies and to compare the qualitative responses with those from the questionnaire.

1. **Construct validity** The results from a principal components factor analysis were used to reduce the questionnaire to a 12 item scale.

2. **Reliability** The measure was tested for reliability by calculating Cronbach's alpha.

3. **Criterion-related validity** Again the two global items measuring perceived overall satisfaction and success of application were assumed to be valid measures and the sum of these two items was used as a criterion scale. Each item on the 12-item measure was correlated with the criterion scale to check for criterion-related validity.

4. **Convergent and discriminant validity** The authors tested the measure for convergent and discriminant validity using both interview and questionnaire responses as a basis for the MTMM analysis.

Straub (1989) describes how he designed an instrument to measure computer abuse. He used the field of criminological theory to "postulate initial causal linkages" and to develop testable propositions. From these, Straub (1989) constructed a draft instrument. Straub (1989) describes his work in phases as given below.

**Phase 1. Pre-test** Straub (1989) devised a draft questionnaire from a review of the literature and conducted three sets of interviews in which the questionnaire was discussed and improved after each interview. The final questionnaire included a
variety of question formats including 5 point Likert scales. The method followed for questionnaire construction establishes content validity.

**Phase 2. Technical validation** At this stage, responses from a questionnaire presented verbally to managers were compared with written questionnaire responses made independently from other members of the organization. Straub (1989) used these results to test for construct validity by using the MTMM analysis. The author appears to use the different items in the questionnaire as the “multi-traits” while the “multi-methods” criteria were met using the responses gained from the pen and pencil and interview methods of questionnaire presentation.

**Phase 3. Pilot Test of reliability and construct validity** Straub (1989) tested the questionnaire for reliability by calculating Cronbach’s alpha. He tested the questionnaire for construct validity by performing a Principal Components Factor Analysis.

**Phase 4. Full scale survey** At this stage Straub (1989) carried out a full survey using his validated questionnaire and was able to make inferences about the causal relationships he had hypothesized.

**Review**

In summary, five papers from the field of MIS have been examined for their descriptions of the processes they used to validate their measuring instruments, in this case, questionnaires. The instruments were tested for the validities as summarized in the table below.
It can be seen that all the instruments were tested for reliability, four specifically mentioning the use of Cronbach’s alpha. Construct validity was also examined for each instrument but was established using a variety of methods.

These papers provide a useful summary of how to produce validated measuring instruments. However, one other paper in the unrelated field of marketing is recognized in the research community as providing an excellent methodology for developing marketing measures. The method described can easily be applied to instrument development in the subject areas of MIS and GDSS. The paper of interest is that of Churchill (1979). The procedure he suggests for developing better measures of marketing constructs is as follows.

1. Specify the domain of the construct; this can be established as a result of a literature search.
2. Generate a sample of items using a literature search, experience surveys, insights, stimulating examples, critical incidents and focus groups.
3. Collect data.
4. Purify the measure using coefficient alpha and factor analysis.
5. Collect further data.
6. Assess reliability using coefficient alpha and split-half reliability.
7. Assess validity using the MTMM analysis and criterion validity. For the MTMM matrix, Churchill (1979) uses a Likert scale and a thermometer scale as different measurement methods.
8. Develop norms, average and other statistics summarizing the distribution of scores.

Churchill’s (1979) paper and those reviewed earlier from the field of MIS will be used to guide the methodology in this research for developing a valid and reliable measure. A hybrid of these methods was chosen for this study; the methodology is discussed in detail in Chapter Five.

4.11 Attitude measurement and measurement scales

One of the aims of this research is to develop a questionnaire which assesses group members’ perceptions of a GDSS supported meeting process and its outcomes. In order to elicit their perceptions, the questionnaire will ask respondents for their attitudes regarding the meeting process and outcomes. This section presents a discussion on attitude measurement and measurement scales.

4.11.1 Attitude measurement

Attitudes can be defined as an individual’s preferences, inclinations, views or feelings about some phenomenon as opposed to opinions which are verbal expressions of attitudes (Churchill, 1991). The terms are frequently used interchangeably. In this research, the questionnaire is concerned with measuring the group participants’ attitudes to the group process and outcomes.

To measure attitudes, researchers most often use self-report attitude scales. These rating methods represent one of the most popular and easily applied data collection methods (Green and Tull, 1988). There is a variety of such scales, for example, Thurstone’s equal appearing intervals, Guttman’s scale and Likert scales. Examination of the questionnaires used in the studies reviewed in sections 4.1 to 4.3 and of those used by practitioners reveals that the most commonly used rating method in GDSS and DSS research questionnaires has been Likert summated rating scales.
The table below shows the type of measuring scales used by the researchers and, where appropriate, the number of points per scale.

<table>
<thead>
<tr>
<th>Study Questionnaires Using Likert scales</th>
<th>Points in Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nunamaker et al. (1988)</td>
<td>mainly 10</td>
</tr>
<tr>
<td>Sharda et al. (1988)</td>
<td>10</td>
</tr>
<tr>
<td>Connolly et al. (1990)</td>
<td>7</td>
</tr>
<tr>
<td>Gallupe and DeSanctis (1988)</td>
<td>7</td>
</tr>
<tr>
<td>Jarvenpaa et al. (1988)</td>
<td>7</td>
</tr>
<tr>
<td>Jessup and Tansik (1991)</td>
<td>7</td>
</tr>
<tr>
<td>Watson et al. (1988)</td>
<td>7</td>
</tr>
<tr>
<td>Green and Taber (1980)</td>
<td>5</td>
</tr>
<tr>
<td>Guimares et al. (1992) (DSS)</td>
<td>5</td>
</tr>
<tr>
<td>Lewis (1987)</td>
<td>5</td>
</tr>
<tr>
<td>Martz et al. (1992)</td>
<td>5</td>
</tr>
<tr>
<td>Nunamaker et al. (1989)</td>
<td>5</td>
</tr>
<tr>
<td>Sanders and Courtney (1985)</td>
<td>5</td>
</tr>
</tbody>
</table>

**Practitioner Questionnaires using Likert scales**

- Decision Conferencing (LSE) variation of Likert 7 point categories
- Decision Conference (USA) 4, 5, 6
- Group Systems (Arizona) 5

**Studies using Semantic Differentials**

- Baroudi and Orlikowski (1988) (MIS)
- Ives et al. (1983) (MIS)

Likert scales ask respondents to indicate their level of agreement or disagreement with a series of statements by marking the appropriate cell. The scales typically consist of 5 or 7 point scales with ratings from “strongly disagree” to “neutral” through to “strongly agree”. Semantic differentials have also been used but are less common. Semantic differentials consist of a concept to be rated according to several
bi-polar adjective pairs, each of which is separated by typically a 7 point scale. Once again, respondents are required to mark the appropriate cell. Semantic differentials are relatively difficult to generate in comparison to Likert scales and people are generally more familiar with responding to Likert scales.

The purpose of the Likert scale is to place an individual's attitudes somewhere on an agreement continuum. The set of items comprising the questionnaire are of equal "attitude value" so there is no scaling of items; it is the individuals responding to the items who are scaled. The use of 5 or 7 point Likert scales allow for the intensity of feeling of an attitude to be expressed. The advantage of this is that it produces greater variance in respondents' scores than if only 2 or 3 response categories were available. The disadvantage of using summated rating scales is that responses can contain "response-set variance" (Kerlinger, 1973). This occurs when individuals have tendencies to use certain types of responses, for example, extreme or neutral responses. Such response variance confounds the attitude variance. Respondents may be tempted to respond to the questions by answering with the same response each time by marking down one side of the scale and without reading the question. It is possible to check for this response pattern in the questionnaire by wording some of the questions in such a way that a reverse attitude response would be expected.

Researchers have assessed the advantages of Likert scales. Seiler and Hough (1970) reviewed a number of studies which compared the use of Likert scales with Thurstone's scales. They concluded that Likert scales were as reliable, and in some cases more reliable, than Thurstone's scales and they were easier to construct. Poppleton and Pilkington (1964) found Likert scales produced slightly higher coefficients of criterion validity than other scales but could not draw strong conclusions. Tittle and Hill (1967) found that responses to semantic differentials were less strongly related to behaviour than the measurement on other scales, particularly Likert scales.
4.11.2 Measurement scales

The type of attitude scales used in a questionnaire determines the sort of statements that can be made about one individual’s attitude compared to another regarding the property under study. Measuring attitudes using rating scales typically entails the assignment of numbers to represent differences in attitudes. Likert scales represent an ordinal level of measurement, that is, they contain two or more categories for defining variables and involve some degree of ordering (Gill and Johnson, 1991). Different points on the scale indicate greater or lesser amounts of the phenomenon being assessed. However, the difference in rank does not specify the size of differences. Any order-preserving transformation of the data does not change the information contained in an ordinal scale; it does not matter what numbers are given to the categories of the scale as long as the order is maintained, for example, with the “greater than” or “more preferred” categories consistently rating higher than the “less than” or “less preferred” categories. The level of scales used is significant in dictating the type of statistical tests which can be used for analysis of results. For an ordinal scale, hypotheses are typically tested using nonparametric tests (Siegel, 1956).

Review

This section has reviewed the types of rating scale used in GDSS research and has examined in greater detail the use of Likert summated rating scales as a way of measuring people’s attitudes. It should be stressed that the attitude questionnaire measures a person’s attitude to an object and not attributes of the object itself. The manipulation and analysis of gathered using Likert scales were briefly considered.

Likert scales are relatively easy to develop, people are generally more familiar with them than with other scales, they have been used frequently in GDSS research and they have performed favourably in tests comparing their use with other scales. Consequently, Likert scales will be used for the questionnaire in the current research.
4.12 Use of laboratory studies and field studies

The studies reviewed in sections 4.1 to 4.3 revealed that while some researchers concentrated on research with real groups of people working in real problem-solving situations, that is, field studies, others focussed on the use of laboratory experiments with contrived groups, composed of students. Field studies are concerned with researching "natural" ongoing systems while intruding upon and disturbing them as little as possible. Laboratory experiments attempt to create the "essence" of the system under study within a context which allows the researcher control over many extraneous variables in order to focus on particular variables of interest (McGrath, 1984). Field studies gain realism and external validity at the price of low generalizability and lack of precision, while laboratory experiments maximise precision of measurement and control of variables but suffer from a lack of realism and low generalizability (McGrath, 1984).

DeSanctis (1989) advocates the use of laboratory research for several reasons. Laboratory experiments allow researchers to isolate behaviours, to manipulate situations and to vary critical contingencies. Groups can be observed at a closer level. There is likely to be less time commitment required from laboratory groups and less associated risk as they are less likely to withdraw from the research than are real groups. In laboratory tests, DeSanctis (1989) suggests using groups who have experience of working together, who intend to work together again in the future and who have a vested interest in the group activities and outcomes. One example of such a group is students working in teams as part of their coursework. If such a group is not available, DeSanctis (1989) believes researchers must either sacrifice statistical power by studying fewer groups or extend the data collection time.

DeSanctis (1989) identified a number of problems associated especially with small group research, a situation frequently met when studying meeting processes.

1. It is difficult to identify consistent patterns across groups.
2. It is difficult to evaluate the process and outcomes of groups.
3. It is difficult to apply statistical analysis methods to empirical data where the group is the unit of analysis. It requires an extremely large sample size to detect
significant effects.

4. There is the constraint of time and financial costs associated with collecting data from large sample sizes.

DeSanctis (1989) believes all these problems arise in either field or laboratory research but they may be more exaggerated in field studies where "live groups" are less accessible for observation, are rarely available in large numbers and problems of confidentiality arise.

In contrast to laboratory experiments, field research comes closer to the reality of ongoing organizational life, but in the process there is considerable loss of experimental control (Klaus and Bass, 1982). The ability to make strong causal inferences is difficult as other uncontrolled factors may be operating in such a way that any effects that may have been identified could be due to the influence of other variables either not being measured or being measured inadequately. Klaus and Bass (1982) also consider that in any social science research, researchers are faced with two trade-offs, firstly, between experimental control and capture of real world conditions in which a problem exists and secondly, between costs of time and money in following a particular research design and the opportunity and feasibility of certain research designs.

Controlled experiments entail holding some variables constant. However, even if a group is chosen on one homogeneous attribute then the members are likely to be heterogeneous on many other variables; one cannot possibly manipulate all potentially relevant variables. This poses a major problem for researchers concerned with studying groups (Steiner, 1972).

A number of arguments for the use of real groups in GDSS research has come from researchers in the field. Jarvenpaa et al. (1988) believe much GDSS research to have limited research benefits partly because they used students who were naïve users of computer support and they also researched single meeting experiments that did not allow for learning through repeated use of technology. Nunamaker et al. (1987) who studied managers conducting actual planning sessions, detailed a number of reasons
for using such subjects as follows.
1. It tests the system with the intended end users of the system.
2. It tests the use of the system with complex, unstructured decisions of the type the system was designed to address.
3. It assures there is commitment on the part of the subjects to the problem or task.

The one drawback to using real groups is the inability to control the research design but assessing real groups presents a realistic view of the system in operation (Nunamaker et al., 1987).

Gear et al. (1993) express a number of concerns about the use of laboratory experiments, namely the experience and training of the participants in the kind of decisions in which they are involved in the study, the realism of the decisions, the availability of information, the reward structure and the commitment to the outcome. Furthermore, decision makers in organizations are involved in the complex social and political relationships of the work place as well as in work-related relationships and rôles which influence the decision making process.

Eden (1992b) considers that while controlled laboratory experiments provide some useful insights into a GDSS group-supported process, they are limited in that they study only a restricted number of experimental conditions. They tend to deal with the complexity of the group decision making situation by reducing the complexity, a process which is obviously impossible in real situations. Eden (1992b) believes that controlled experiments are particularly inappropriate for evaluating UK systems.

Review

Arguments have been presented both for and against the use of real groups in GDSS research. While laboratory research may be appropriate for studying the impact of specific features of GDSS on group decision making, to understand how GDSS affect the process and outcomes in those complex situations for which they were designed, research must be carried out with real groups using GDSS on real problems. Although this produces problems with time constraints, generalization of results and
confidentiality of issues, it is difficult to recreate the true atmosphere of a decision-making group in a laboratory using student groups. Such experiments would raise questions about the external validity of the results and their generalization to real groups.

For this research, as the questionnaire is intended to be used by real groups, then in order to establish external validity of the results, it is necessary to test the questionnaire with real groups.

4.13 Resumé of research and literature review

In this chapter, studies of GDSS were reviewed and the models used by researchers from which to shape their research were presented. Other research frameworks in the field of GDSS were discussed and a number of models, relevant to GDSS, but from other fields, were examined. The evaluation of GDSS was considered, in particular, the need to evaluate, methods of evaluating and the use of questionnaires were discussed. Types of validity and reliability were examined and methods of testing measuring instruments for these were presented. A review was given of the methods adopted by several researchers in the area of MIS to develop valid questionnaire. Attitude measurement and measurement scales were examined. The use of laboratory and field experiments in GDSS research were compared.

Several important points emerged from the review of the literature.

1. A review of GDSS research found that while a number of researchers used a research framework to guide their studies, there was no standard framework which would promote cross-comparison of study results and more efficient interpretation of results and conclusions. The models used were found to have deficiencies particularly for those GDSS which do not rely on the use of computers.

2. The importance of evaluating GDSS was highlighted and questionnaires composed of Likert scales were shown to be the most frequently used method for evaluating GDSS. The importance of instrument validation was stressed in order that
questionnaire results can be accepted as valid and reliable.

3. Research in GDSS has followed two main strands. Firstly, the use of laboratory experiments and groups comprising students have examined in depth the effect of one aspect of the GDSS upon the group process while manipulating other variables. The second strand of research has centred on the use of GDSS by real groups in real problem solving situations where the GDSS is examined in the complex environment for which it was designed. A debate on the use of laboratory versus field experiments highlighted the fact that field experiments, although difficult to carry out in terms of time and the number of possible influencing variables in the environment, are the most suitable method in GDSS research for producing useful, generalizable and externally valid results.

The literature review has determined the form of the current research and the methodology adopted to achieve the aims. In particular there is a need for a comprehensive framework which presents those variables that characterize a group process and that addresses the deficiencies identified in previous frameworks. The measuring instrument used in this research to evaluate GDSS use is a questionnaire, composed of Likert scales. The questionnaire will be tested for validity and reliability using real groups. The methodology is discussed in detail in Chapter Five.
Chapter Five

Methodology
Introduction

This chapter describes the methodology followed in this research to achieve the aims presented in Chapter One and discussed in greater detail in Chapter Three. The chapter opens with an outline of the methodology and then each step of the methodology is discussed in detail.

5.1 Outline of experimental work

The methodology followed in this research to produce a valid and reliable questionnaire is an amalgamation of Churchill’s (1979) procedure for developing better measures of marketing constructs and the procedures followed by researchers devising end-user computing satisfaction questionnaires, as discussed in section 4.10. The methodology is divided into three main stages as summarized below.

Stage 1 Pre-test

1a. Specify domain of the construct.

1b. Postulate causal linkages.

2. Establish content validity of the framework.

3a. Generate a sample of items.

3b. Design of the Questionnaire

Stage 2 Qualitative validation

4. Establish content validity of the questionnaire.

Stage 3 Quantitative validation

5. Collection of data.
6. Establish reliability of the questionnaire.

7. Establish criterion-related validity of the questionnaire.

8. Establish construct validity of the questionnaire.

Each of the above steps will now be discussed in detail.

5.2 Actual Experimental Design

5.2.1 Stage 1 Pre-test

1. Specify domain of the construct and postulate causal linkages

Initially the researcher needs to define operationally the construct of interest (Straub, 1989). This involves specifying what is included and what is excluded in the definition of the construct (Churchill, 1979). Churchill (1979) states that it is imperative to “consult the literature when conceptualizing constructs” and specifying domains of interest. It is important to review fields related to the construct under study as these can offer further useful theories pertaining to the area of interest (Ives and Olson, 1984). Straub (1989) in his article on instrument validation stresses the use of theory to postulate causal linkages between variables.

The above ideas have been taken into consideration in this research. The construct of interest is a process which occurs when a group of people meet at the same place and at the same time to discuss problems and issues requiring group input and maybe a response reaction. The process may be supported by a GDSS. A framework has been devised to represent this process and illustrates the impacts of input variables on the group process variables and subsequently on the outcome variables.

The research framework proposed has been developed from a careful and in-depth review of the relevant literature, such as the literature on group communication, group and task behaviour, group processes and organizational behaviour. The literature search also
entailed a review of studies carried out into GDSS which have identified possible important factors of the group interaction process. As a result of the literature survey, hypotheses were proposed which postulate causal linkages between input, process and output variables, that is, that certain input variables influence the group process variables which in turn affect the group process outcomes. The framework was developed from many such hypotheses and evidence is provided to support the inclusion of each variable or hypothesis (see Appendix One for a description of the framework).

2. **Content validity of research framework**

The questionnaire for measuring group members’ perceptions of the process and outcomes of a meeting using a GDSS will be developed directly from the framework, and hence it is important to establish content validity of the framework. Content validity has been substantiated to a certain degree by the method adopted in the development of the framework, as described in (1) above. However, as stated in section 4.9.1, establishing content validity often relies on the judgement of experts in the field. Consequently, the framework, its structure and its variables were discussed with a variety of experts in the field of GDSS. It is necessary that the framework is discussed with as wide a range of experts, in terms of both type of GDSS expertise and level of experience, as possible in order to get a wide spread of opinions about the framework. It is accepted that this means the framework was discussed from a practitioners’ point of view as opposed to that of group members.

The practitioners with whom the framework was discussed are listed below. They have been categorized into groups according to their area of GDSS expertise. The particular GDSS with which they are involved is indicated where appropriate.

a. Facilitators
   Facilitators - Rolls Royce plc.: JAD

b. Consultants and designers of GDSS
   Dr. Fran Ackermann, University of Strathclyde: SODA.
   Prof. Simon French, University of Leeds: Decision Conferencing.
   John Friend, Stradspan Ltd.: Strategic Choice.
Dr. Tony Gear, Decision Dynamics: Teamworker.
Wm. Benjamin Martz, Jr., President, Ventana Corporation: GroupSystemsV.

c. Vendors
Tim Morgan: Decision Conferencing, ICL.

d. Informed Users
David Patching: SSM.

e. Academics
John Mingers, The University of Warwick.
Professor Jim Bryant, Sheffield Hallam University.
Associate Professor Leonard Jessup, California State University

The comments of these experts have been incorporated into the framework; for example, by adding variables which they believe to be important. Their individual comments are not discussed here but are presented in the description of the framework (Appendix One).

The construct domain of the current research has been defined, the relevant literature has been used to suggest hypotheses and causal linkages between variables and the resulting framework has been discussed with 11 GDSS experts of differing expertise. Therefore, content validity of the framework has been established.

3a. Generate a sample of items

This stage of the research methodology is concerned with producing the questionnaire. It entails choosing which questions to include in the questionnaire and is also concerned with the physical aspects of questionnaire development.

In this research, it is intended that the questionnaire will assess group members' perceptions of the process and outcomes of a GDSS supported process. The decision about which items to include in the questionnaire is based on the process and outcome variables in the framework. These variables have been identified from the literature survey as being pertinent to the process of a group meeting. Thus, the questionnaire will
be developed directly from the framework with each item designed to assess one of these process or outcome variables of the framework which are measurable.

3b. Design the questionnaire

The items to be included in the questionnaire have been identified. Important physical aspects of questionnaire design will now be discussed.

Section 4.11.2 discussed the type of rating scales which can be used to measure an individual’s attitudes. As a result, Likert scales were chosen for the questionnaire to assess the group participants’ perceptions of the group process and outcomes.

Churchill (1991) proposes a guide to developing questionnaires which consists of the nine steps shown below.

1. Specify the information sought.
2. Determine the type of questionnaire and method of administration.
3. Determine the content of individual questions.
4. Determine the form of response of each question.
5. Determine the wording of each question.
6. Determine the sequence of questions.
7. Determine the physical characteristics of the questionnaire.
8. Re-examine steps 1 to 7 and revise the questionnaire if necessary.
9. Pretest the questionnaire and revise if necessary.

The above steps will be considered in greater detail to illustrate the process used to devise the questionnaire in this research.

1. Specify the information sought
The information to be sought by the questionnaire is predetermined in this research as the questionnaire will be developed directly from the framework.

2. Determine the type of questionnaire and method of administration
As the questionnaire is to be completed by the respondents themselves, it is a self-
reporting questionnaire. Questionnaires vary in the degree to which they are structured. As it is intended for the questionnaire to be completed by the respondents and then undergo statistical analysis, it is necessary for the questionnaire to be well structured in order to make it easier both for respondents to complete and for the researcher to carry out analyses on standardized responses.

3. Determine the content of individual questions
The questionnaire will be devised directly from the framework and therefore it is the variables within the framework which determine the content of individual questions.

4. Determine the form of response of each question
The questionnaire consists of two types of question formats, namely, open-ended and multichoice. Open-ended questions allow the respondents to reply freely to the question using their own words. An advantage of these types of question is that they can elicit creative or original responses and can also provide information about the phenomenon under study which had not been considered before. In this research, open-ended questions were used to allow respondents the opportunity to express in their own words how they felt either about particular aspects of the decision making process or about the process generally. There are two main disadvantages to open-ended questions. Firstly, they require considerable time and effort on the part of the respondent and secondly, they require more time from the researcher in order to code the answers (Sproull, 1988).

Multichoice questions such as Likert rating scales allow the respondent to choose one of a number of responses. These questions are also seen as fixed-alternative questions as the number of responses is limited and the respondent is forced into selecting one of the answers (Churchill, 1991). They do not permit individuals to elaborate upon their true position but require them to condense their possibly complex attitude into a single statement (Churchill, 1991). The principal advantage of these types of questions is that they are simple to administer and, as the answers are standardized, the results are easy to tabulate and analyze.
5. Determine the wording of each question
The questions were worded to try to capture as accurately as possible the meaning of each variable in the framework. However, several guidelines were followed for determining the wording of the questions, such as using simple words and avoiding ambiguous words and questions, leading questions, double barrelled questions and negative questions (Churchill, 1991).

6. Determine the sequence of questions
The sequence of the questions was determined to some extent by the order of the variables in the framework. However, account was also taken of the fact that it was necessary to make the sequence of questions appear logical to respondents and to try to make a clear split between process and outcome variables.

7. Determine physical characteristics of the questionnaire
The physical characteristics of the questionnaire play an important role in gaining a respondent’s cooperation to complete the questionnaire. They were most important in the current research as the author had no direct contact with the respondents and maximizing subject co-operation could only be done via the questionnaire. As a consequence, considerable time and effort was devoted to the planning and presentation of the questionnaire.

Sproull (1988) offers some suggestions on how to increase the response rate of the questionnaire:
- write clear directions;
- mention how little time is needed to complete the questionnaire;
- structure question responses so the respondent can answer the questions quickly and easily;
- structure questions carefully.

It is important to begin the questionnaire with an introduction which is designed to tell respondents about the questionnaire, what it is for, the importance of the project and of respondents' replies, how long the questionnaire takes to complete, how the respondents benefit from it and the appreciation of the researcher. Gill and Johnson (1991) suggest
that if the purposes of the research are revealed to respondents this increases the likelihood of gaining a response. They also propose that instructions to the respondent should be clear and that the questions are easy to understand, being free from jargon and assumptions.

The phrasing of each question is important. Poor phrasing can result in the respondents not understanding the question which leads to item nonresponse or they answer the question incorrectly, either on purpose or unintentionally. This causes measurement error in that the recorded or obtained score does not represent the respondent’s true score. Ambiguous words should be avoided. The wording of each question was carefully considered in this research and the questions were put into slightly lay terms to make them easier to interpret for respondents while at the same time ensuring that the meanings of the variables in the framework, which have been worded in more expert terms, are not lost. The questionnaire was directed towards professional groups using GDSS and hence the wording does not need to be particularly simple, being geared specifically towards this respondent group. It is important for researchers to consider whether the respondents have the knowledge and information to answer the questions (Gill and Johnson, 1991).

Presentation of the questionnaire is of great importance. An attempt was made to make the questionnaire as user-friendly as possible by considering carefully the layout and using bold type to differentiate the questions. A copy of the original questionnaire can be found in Appendix Two. This is the version of the questionnaire which will undergo the tests for validity and reliability as described in section 5.2.3.

8. Re-examine steps 1 to 7 and revise if necessary

9. Pretest questionnaire and revise if necessary
The questionnaire was given to two colleagues in the Business School at Loughborough University for preliminary testing. Any problems they encountered in completing the questionnaire were examined and revisions were made where necessary.
5.2.2 Stage 2 Qualitative validation tests

4. Content validity of questionnaire

To produce a content valid questionnaire by generating a set of items from which to randomly select a sample of items on which to test the respondent, as described in section 4.9.1, would be difficult in this research because the construct of interest is complex. It would entail generating many items to assess each of the variables in the framework. Therefore, an evaluation of content validity of the test instrument relies on a judgement of how representative are the items in the test instrument of the property under study. As the framework has been assessed by experts for its content validity and as the questionnaire has been produced directly from the framework, it is argued that the questionnaire adequately represents the domain of a GDSS-supported group process and outcomes and therefore has content validity. In an endeavour to capture and maintain the essence of each of the pertinent variables of the framework in the questionnaire, the wording of each question has been very carefully considered.

5.2.3 Stage 3 Quantitative validation tests

5. Collect data

At this stage data needs to be collected before any further tests can be carried out. This section discusses five practical aspects of data collection.

1. Use of field studies

The advantages and disadvantages of field studies as opposed to laboratory studies in GDSS research were examined in section 4.12. Following this discussion, it was decided that in this research data collection would be carried out in the field setting using “live” groups, as this would enhance the external validity of the research findings. As the questionnaire is to be validated so that it can be used with confidence in future research with “live” groups, it was imperative for it to undergo tests with “live” groups, that is with groups similar to those for which it was designed.

2. Sampling procedures

Once the research problem has been defined and a measuring instrument has been
developed, it is necessary to determine how to select those respondents from which data will be collected (Churchill, 1991). Frequently, researchers collect data from a portion of the population by taking just a sample of elements from the larger group and, on the basis of information collected from this subset, make inferences about the larger group. The term “population” is defined as the totality of cases that conform to some designated specifications. In this research, population refers to all those groups who are using a GDSS to aid them in their group work. In general, the simpler the definition of the population the higher the incidence and the easier it is to find a sample. A sample is selected from the sampling frame which can consist purely of a list of the population elements. The method of sample selection depends on the type and availability of samples.

Nonprobability sampling refers to the selection of samples either on the basis of the judgement of the researcher or on some other nonrandom process rather than the use of devices such as a table of random numbers (Green et al., 1988). An example of nonprobability sampling which is used in this research is convenience sampling. As the name suggests, the researcher uses samples that are convenient as subjects (Sproull, 1988). Convenience sampling includes the case where the researcher asks for volunteers and those people who come forward are used as the sample (Churchill, 1991). An advantage of convenience sampling is that the subjects are easy to access, but a disadvantage is that they are likely to be biased. The researcher has no way of knowing whether the sample is representative of the target population. An evaluation of the representativeness of the sample of the target population can be carried out following data collection as researchers assess the results and intuitively gauge the representativeness of the results. Furthermore, field studies in GDSS research have relied on studying groups who have expressed an interest in using a GDSS to aid their group process and who are willing to complete questionnaires. The use of groups that are biased to a certain degree is an inherent part of all practical GDSS research.

In this research, finding a sample of subjects entailed identifying organizations within which groups used GDSS to support them in their decision making. A member of personnel involved with the groups was identified (in some cases this was the facilitator), and a request was made to them to ask members of a group if they would be prepared to
cooperate in the research. Those groups that were prepared to help with the research became the sample. In order to generate an adequate sample size, this procedure of selecting a sample was necessary in this research as there are major difficulties in obtaining access to companies and to confidential meetings involving managers and chief executives.

3. Sample size
In this research, data were collected from members attending meetings supported by different GDSS in order to enhance the external validity of the findings. To decide how many meetings from which to collect data it is useful to look at past research practice. From the studies reviewed in this thesis the following information was found concerning the sample size of studies. The studies are grouped according to the type of research (as discussed in section 4.1 to 4.3).

**Computer-based support as opposed to non-computer or no support**
3. Mackay et al. (1990) 18 professional people.
5. Watson et al. (1988) 44 student groups of 3 and 38 groups of 4.

**Effects of a particular GDSS feature**
1. Connolly et al. (1990) 72 students into groups of 4.
2. Hiltz et al. (1989) 6 manager groups of 5.

**Field studies**
1. Guimaraes et al. (1992) 118 questionnaires
3. Nunamaker et al. (1987) 7 groups representing 100 participants of high level managers.
Instrument validation studies


The sample sizes ranged from approximately 18 to over 100 respondents and no particular pattern arose according to the type of research performed. A suitable sample size depends on many factors, including the type of sample, the statistics to be performed on the data, homogeneity of the population and time, money and personnel constraints of the research (Churchill, 1991). The current research had a pre-determined aim of sampling 4 groups since if meetings have an average of 10 members per meeting there was the potential for the completion of 40 questionnaires, a value in the range adopted in previous studies. It is also appropriate to sample groups using different types of GDSS, including both manual or facilitator-led GDSS and those using computers. The table below shows the companies and the type of group decision support used by groups in their meetings for which questionnaires were completed.

<table>
<thead>
<tr>
<th>company</th>
<th>type of support</th>
<th>number of completed questionnaires</th>
<th>number of meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>manual, facilitator led</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>JAD (manual, facilitator led)</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Decision Conferencing (computer modelling)</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Decision Conferencing (computer modelling)</td>
<td>29</td>
<td>series of meetings for one project</td>
</tr>
</tbody>
</table>

Descriptions of the meetings are presented in Appendix Four.

4. Field procedures and nonsampling errors

There are two basic types of error associated with data collection, sampling error and nonsampling error. Sampling error is associated with the fact that different samples will produce different estimates of a parameter. This is often overcome by increasing the sample size.
Nonsampling errors reflect the many other types of errors that can arise in research. These are of two basic types, nonobservation and observation errors (Churchill, 1991).

Nonobservation errors result from a failure to obtain data from parts of the survey population either because parts of the population of interest were not included or because some elements designated for inclusion did not respond. Noncoverage or exclusion of elements of interest is essentially a sampling frame problem, for example, elements that are representative of the population were not included in the sampling frame. Nonobservation errors due to a poor sampling frame cannot be dealt with in this research where no sampling frame was used. Nonobservation errors due to subjects designated for inclusion not responding can be minimized by attempting to maximize subject cooperation and questionnaire completion by careful design of the questionnaire.

Observation errors arise due to the securement of inaccurate information from sample elements or from errors introduced in processing the data or in reporting findings (Churchill, 1991). Inaccurate information arises after a respondent has agreed to participate but does not cooperate fully by failing to answer all the questions (Churchill, 1991). Observation errors due to careless data handling and processing can be minimized by being as accurate and as careful as possible in handling the data. Errors due to inaccurate information collected from the respondents can not easily be dealt with.

5. Additional data
A meeting description form was developed for the facilitator to complete in order to provide a more comprehensive description of the meetings. The meeting description form aims to cover the input variables of the framework (see Appendix Three for a copy of the facilitator's form).

6. Reliability of the questionnaire
Several methods for testing reliability have previously been discussed in section 4.9.2. The test/retest and parallel or alternate forms methods were considered unsuitable for this research as both methods involve testing the respondents twice and it was unlikely that this opportunity would arise in this research. Another method discussed for testing for reliability is to calculate the internal consistency of the test. The split-half test of
reliability would be inappropriate as half of the items of the questionnaire would not be comparable with the other half. Thus, in this research it is proposed to test for reliability by calculating Cronbach’s alpha which compares the results of each individual question with the total score.

7. Criterion-related validity

Criterion-related validity, discussed in section 4.9.1, was seen to consist of two types, namely concurrent validity and predictive validity. Concurrent validity compares the results of the measure of the criteria using the instrument under test with actual measures of the criteria taken at the same time. In this research, there are few alternative instruments available to measure the same criteria as those assessed in the questionnaire. However, in their study to validate a computer user satisfaction questionnaire, Doll and Torkzadeh’s (1988) used what they termed “global measures” as criterion variables which involved incorporating into the questionnaire one or two questions designed to measure the respondent’s overall feelings towards the construct of interest. For example, in Doll and Torkzadeh’s (1988) study, responses to a global measure of satisfaction were compared with responses to other questions measuring finer details of satisfaction. Four global questions have been incorporated into the questionnaire in the current work and these are concerned in a general manner with a respondent’s degree of happiness and overall satisfaction with the process and outcomes. The four global questions in this questionnaire are as follows:

1. How happy were you with the process?
2. What is your overall level of satisfaction with the process?
3. How happy were you with the decisions reached?
4. What is your overall level of satisfaction with the decisions reached?

As the questionnaire focuses on the process and outcomes of meetings, it is suitable to include two global questions focusing on each of these two major aspects. In Chapter Seven, the results from these global questions are compared with the scores from the relevant individual questions.
8. Construct validity

Section 4.9.1 suggested several methods for determining construct validity of a questionnaire. Two subcases of construct validity are convergent validity and discriminant validity, both of which are frequently analysed using the multitrait-multimethod (MTMM) technique. However, this technique requires that two or more traits are measured by two or more methods which are maximally different from each other. This entails testing respondents more than once and, although the measures can be used at the same time, it still requires a substantial time commitment from respondents. Therefore, to maximize participation by groups in this research, the MTMM technique was considered inappropriate.

The questionnaire was tested for construct validity using Principal Components Factor Analysis. Once the data had been collected using the questionnaire, factor analysis was carried out in order to analyze the interrelationships among the variables. Due to the format of the questionnaire, factor analysis can only be performed on the variables within each separate scale assessing various aspects of the meeting process and its outcomes.

In summary, quantitative validation of the questionnaire will involve tests for Cronbach’s alpha, criterion-related validity and factor analysis for construct validity.

Review

This chapter has described the methodology adopted in this research to achieve the research aims presented in Chapter One. Statistical tests to be carried out in order to validate the questionnaire have been identified. Appendix Five presents the hypotheses on which the statistical tests are based are presented and states whether the statistical results support each hypothesis.
Chapter Six

Research Framework
Chapter Six: The Research Framework

Introduction

This chapter presents the research framework which is designed to model GDSS-supported group processes. The framework incorporates those input variables which influence the group process and outcome variables. The following discussion includes an overview of the framework and its major components; the framework variables are presented as listed. A detailed description of the variables is given in Appendix One.

Five terms used in this chapter need to be defined.
1. A “project” consists of one or more sessions of cooperative working involving a common theme and is complete when the decisions or solutions associated with it have been implemented.
2. A “meeting” is a session of cooperative working involving one or more tasks.
3. A “task” is equivalent to an agenda item.
4. Each item may involve several “subtasks” such as brainstorming, listing, voting and information passing.
5. Where no distinction is made between project, meeting, task and subtask the term “group task” will be used.

As described in Chapter Two, the group process is concerned not only with decision-making and problem solving but also with many kinds of activities requiring group co-operative work.

6.1 An overview of the research framework

The research framework illustrated in figure 8 consists of six major components. Three of the components are associated with the context in which the group process occurs, namely the outer-organizational, the organizational and the group environment. Two of the components are concerned with outcomes from the process, namely substantive outcomes and process performance indicators (PPIs) (Patching, 1993b), and one with the process itself. The outer-organizational environment represents the environment in which the organization operates and to which it must adapt to ensure survival, while the organizational environment represents the context in which groups operate to ensure the organization’s continued existence by
responding to changes in the outer environment. It is within the group environment that the group process occurs and that ideas, information and opinions are exchanged, decisions are taken and issues are resolved in order to identify appropriate responses and to formulate unified courses of actions for groups within the organizational environment.

**Figure 8** The research framework
Outcomes from the group process are of two types.

1. Substantive outcomes refer to the results produced as a consequence of the group’s cooperative working. According to the aims of the group’s work, the results may be a group understanding of a situation, structuring of a problem or a definition of a solution to a problem. The variables in the framework which refer to the substantive outcomes of the group process are concerned chiefly with their characteristics. The implementation of the outcomes of the group process influences actions within the organizational environment which will in turn affect the outer environment. As Hall (1974) states, an organization transforms its inputs from the environment into an output which feeds back into the environment. The organizational output is consumed, utilized and evaluated by the environment and thus, has an impact on future inputs (Hall, 1974).

2. PPIs represent indicators of the efficiency and effectiveness of the process. PPIs can be either tangible in nature, such as the time taken to reach decisions, or intangible, such as group members’ level of satisfaction with the process.

The lower part of figure 8 illustrates the group process in greater detail. The group context in which the group process takes place is characterized by features of the individual group members, the group structure and situation, the task the group is tackling and the group decision support provided to the group. Normally, the features which characterize the group process can be expected to remain largely unaltered over the period of a project.

A group may need to participate in several sessions of cooperative working in order to achieve an overall project goal. This is an important characteristic of the model for two reasons. Firstly, an individual’s perceptions of the process performance indicators from one session will influence their participation in subsequent sessions and this is represented in the model by a feedback loop. Secondly, it provides a dynamic element to the group process model. At the end of one session of a project, unresolved issues will remain outstanding and new issues will have arisen requiring further work, prior to the next session.
6.2 The research framework variables

Each of the components of the model is composed of several variables as listed below. For the appropriate process and outcome variables, the numbers following the variables indicate the corresponding question number in the questionnaire which assesses that variable.

<table>
<thead>
<tr>
<th>Input Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outer organizational environment</strong></td>
</tr>
<tr>
<td>Complexity</td>
</tr>
<tr>
<td>Dynamism</td>
</tr>
<tr>
<td><strong>Organizational environment</strong></td>
</tr>
<tr>
<td>Organizational climate</td>
</tr>
<tr>
<td><strong>Group environment</strong></td>
</tr>
<tr>
<td>Group members</td>
</tr>
<tr>
<td>Attitude</td>
</tr>
<tr>
<td>Ability</td>
</tr>
<tr>
<td>Background</td>
</tr>
<tr>
<td>Emotional state</td>
</tr>
<tr>
<td>Culture</td>
</tr>
<tr>
<td>Decision-making style</td>
</tr>
<tr>
<td><strong>Group situation</strong></td>
</tr>
<tr>
<td>Reasons for group membership</td>
</tr>
<tr>
<td>Stage in group development</td>
</tr>
<tr>
<td>Existing social networks</td>
</tr>
<tr>
<td>Accountability</td>
</tr>
<tr>
<td>Commonality of goals</td>
</tr>
</tbody>
</table>
Group structure

Work group norms
Power relationships
Status relationships
Breadth of participants
Group cohesion
Density of group

Group support

Type of support
Degree of structure
Degree of anonymity
GSS Personnel
Physical setting

Task characteristics

Nature
Complexity
Uncertainty
Duration
Structure
Urgency
Importance
Decision-making phase

Pre-work

| Group Process Variables |

Communication characteristics of process

Exchange of information
Task communication
Non-verbal communication
Co-operation
Negotiation
Clarification efforts

**Structural characteristics of process**

Adaptable  (questions 1 and 2)
Data-based  (questions 1 and 2)
Participatory  (questions 1 and 2)
Goal centred  (questions 1 and 2)
Facilitation interventions  (questions 3 and 4)
Focussing on key issues  (questions 3 and 4)

**Outcome Variables**

**Substantive outcomes**

**Decision characteristics**

Legitimacy of decision  (question 19)
Accountability of decision  (question 19)
Supportability of decision  (question 19)
Efficiency of decision  (question 19)
Degree to which objectives are achieved  (question 23)
Political feasibility of decision outcome  (questions 22 and 24)

**Implementation of outcomes**

Cost of implementation
Ease of implementation
Post-work
Issue resolution
Administrative details
Post-process assessment

**Organizational outcomes**

**Organizational effectiveness**
Cash generation
Growth
Innovation
Market share
Profitability
RoI
Technical excellence
Adaption/response to “the new”

**Organizational efficiency**
Communication
Control
Cost savings
Productivity
Teamwork
Time savings

**Process Performance Indicators**

**Tangible process performance indicators**
Time taken (question 14)
Members participation (question 14: 2 items)
Depth of analysis (question 14: 2 items)
Generation of ideas (question 14)
Consensus reached  
Meeting interest  

**Intangible process performance indicators**

**Attitudes towards the process**

- Satisfaction with process  
- More intelligent decisions  
- Extending competences  
- Insights and learning  
- Amount of emotion  
- Understanding of business  

**Attitude towards the outcomes**

- Acceptance  
- Comprehension  
- Confidence  
- Ownership  
- Commitment of group members  
- Satisfaction  

**Attitude towards the group**

- Willingness to work with group again  
- Hedonic Tone  
- Teamwork  

**Review**

This chapter has presented the research framework from which the questionnaire was devised. The components of the framework have been described and the variables contained in the framework have been listed. The variables of the framework which will be assessed by questionnaire have been identified and referenced using the
appropriate question number. A copy of the questionnaire can be found in Appendix Two.
Chapter Seven

Results and Discussions
Introduction

This chapter presents the results of the statistical analysis carried out to test the questionnaire for validity and reliability. Questions are considered in the order they appear in the questionnaire with the exceptions of questions 3a, 21a, 25a and 26a (referred to as criteria questions) which are reviewed under question 3a. For ease of reading and assessing the responses obtained, each question is presented as it appears in the questionnaire; the reader is referred to Appendix Two for a complete copy of the questionnaire.

For each question the frequency count of responses is given followed by the valid percentages which take into consideration missing observations. For two questions (questions 2 and 19), the responses of group members are considered in conjunction with the responses of the facilitators to the same question in their facilitator's form. The hypotheses on which the analyses are based and whether the results support or disconfirm the hypotheses are presented in Appendix Five. The revised version of the questionnaire (see items 3 and 5 below) is presented in Appendix Six.

7.1 Basis of analysis

The analysis presented in this chapter is based on six assumptions as listed below.

1. The analysis for criterion-related validity has entailed investigating whether two variables are associated with each other. This involves carrying out a procedure called crosstabulation and is a common method for describing the distribution of two or more variables at a time (Dillon et al., 1994). A table classifying the levels of one variable with the levels of another provides the frequency distribution and is called a contingency table. The chi square test can be calculated to assess the level of independence between the variables. In this research the majority of variables have been rated according to 5 point Likert scales. Producing contingency tables illustrating the distribution of two such variables with 57 respondents lends weaknesses to the results with many cells containing too few responses to provide adequate statistical strength. Therefore, in order to produce statistically valid results, the 5 point Likert scales have been recoded into only two categories so that when
assessing the distribution of two variables, the resulting 2 x 2 contingency tables constructed have an acceptable level of responses per cell. Each recoding of the scales was carried out in the same manner. For example, members' “degree of happiness with the process” has been rated according to a 5 point scale of “very unhappy” (scale point 1) through to “very happy” (scale point 5) and was recoded by recoding scale points 1, 2 and 3 as “1” and 4 and 5 as “2”. Thus, if a member was “very unhappy”, “unhappy” or “neither unhappy nor happy” their response was scored as “1” and if they were “happy” or “very happy” their response was scored as “2”. This is an acceptable method of recoding Likert scales (Coates, 1995). As all the crosstabulations are concerned with 2 x 2 contingency tables, all the chi square statistics refer to the case of 1 degree of freedom.

2. The level of significance for rejecting the null hypothesis has been chosen as 0.05. This level is frequently used by researchers (Kerlinger, 1973; Siegel, 1956).

3. The analyses for criterion-related validity were performed by comparing group members’ responses to four criteria questions, namely, “happiness with the process”, “happiness with the decisions”, “overall satisfaction with the process” and “overall satisfaction with the decisions” with members’ responses to the other items on the questionnaire. The choice of criteria question was based on the following explanation. One method of evaluating GDSS is to investigate which aspects of the process and decisions members found beneficial and which disadvantageous. By examining the degree of association between each questionnaire item with members’ rated degree of happiness either with the process or outcomes, it can be established whether that particular item is associated with their degree of happiness with either the process or the outcomes. If there is no association, the item is not measuring some aspect of process or outcome happiness and is not important in influencing members’ happiness with the process or decisions and can, therefore, be removed from the questionnaire. Conversely, if from the results of the analysis there is found to be an association then the question will be retained in the questionnaire.

4. Principal Components Factor Analysis (PCFA) has been performed on several scales within the questionnaire to test for construct validity. One purpose of PCFA is
to investigate how many factors underly the variance scored on a scale. While assuming that a set of items assesses different aspects of the process or decisions, PCFA helps to identify subsets of items which together measure a more general but separate content area than other subsets. Examination of the content area covered by these subsets aids in assessing whether each subset is measuring some aspect of the construct under investigation. Everitt and Dunn (1991) propose three rules for choosing the number of factors or components underlying a scale.

a) Include just enough components to explain a relatively large percentage of the total variation: figures over 70% are usually suggested.

b) Exclude those principal components whose eigenvalues are less than 1. However, they suggest that in some cases it is better to exclude principal components whose eigenvalues are less than 0.7.

c) Examine the scree plot which is formed by plotting the factors against their respective eigenvalues. It is often possible to identify an elbow in a line drawn to connect these points where the eigenvalues begin to level off to form a horizontal line. The elbow represents the point after which progressively smaller gains in variance are achieved by retaining further factors. The elbow is considered the point where large eigenvalues cease and small ones begin.

The above rules are used in this research. It is not necessary for all three criteria to be met. A factor loading of greater than or equal to 0.4 has been used to determine the cut-off point for assigning variables to factors (Hackett and Foxall, 1994).

5. As a result of the analyses performed, a revised version of the questionnaire will be produced. For each question, a statement is presented on the decision made as to whether a question should be retained in the revised version. Some of the results from the analysis provide strong evidence for either retaining or removing items in the questionnaire. However, for some questions, the evidence was not clear. As a consequence of examining responses to a questionnaire, the researcher can frequently identify questions which did not provide useful data or did not provide additional data that had not been supplied by other questions in the questionnaires. Furthermore, the statistical significance of some results could not be calculated. The use of Likert scales for measuring attitudes, which represent an ordinal level of measurement,
restricts the statistical tests which can be performed to nonparametric tests. Some questions were included at this development stage of the questionnaire which could be removed following the tests carried out. Only those questions for which there was sufficient statistical proof for retaining them in the questionnaire at the level of significance chosen in item 2 above, are retained in the revised version of the questionnaire.

6. The questionnaire contains some open-ended questions. All answers given to these questions were recorded, categorized and presented in the discussion of results. In keeping with the level of significance chosen in item 2 above, only those comments made by at least 5% of the sample will be considered for inclusion in the revised version of the questionnaire. The comments from the open-ended questions are considered together at the end of the chapter (section 7.3). Not all respondents provided answers to the open-ended questions while other respondents gave more than one answer to a single question.

As discussed in Chapter Five, a total of 57 questionnaires were completed from group members attending meetings held within four organizations representing three different types of group decision support. The results of the analysis will now be discussed.

7.2 Results

Section A Characteristics of the meeting process

Questions 1 and 2

The responses to question 1 and 2 are considered together. These questions were included in the questionnaire to determine whether group members were able to identify the type of strategy emphasized by the process they were using. Statements A to D of question 1 were carefully worded in an endeavour to capture the essence of the process according to the four criteria used to provide a standard for the process as suggested by McCartt and Rohrbaugh (1989) and discussed in Appendix One.
Chapter Seven: Results and Discussions

1. Please indicate your level of agreement to the following 4 statements.

<table>
<thead>
<tr>
<th>The process we used today favoured ...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A creative, flexible and innovative ways to make decisions.</td>
<td>0 (0%)</td>
<td>10 (18%)</td>
<td>11 (20%)</td>
<td>27 (50%)</td>
<td>7 (13%)</td>
</tr>
<tr>
<td>B the use and analysis of facts and information in order to reach decisions.</td>
<td>1 (2%)</td>
<td>3 (6%)</td>
<td>4 (7%)</td>
<td>37 (70%)</td>
<td>10 (18%)</td>
</tr>
<tr>
<td>C full participation by all members in extended discussions with open expression of feelings to make decisions.</td>
<td>3 (6%)</td>
<td>3 (6%)</td>
<td>8 (15%)</td>
<td>26 (47%)</td>
<td>15 (27%)</td>
</tr>
<tr>
<td>D a logical, efficient and reasoned approach to reach decisions.</td>
<td>1 (2%)</td>
<td>5 (9%)</td>
<td>9 (16%)</td>
<td>30 (55%)</td>
<td>10 (18%)</td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

2. Which of the 4 statements (A - D) above do you think best describes today's meeting process?

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (15%)</td>
<td>10 (19%)</td>
<td>20 (38%)</td>
<td>14 (27%)</td>
</tr>
</tbody>
</table>

(Total valid cases 52; missing cases 5)

The results from these two questions show that respondents felt that statement C “full participation by all members in extended discussions with open expressions of feelings to make decisions” was the best description of the process they used (question 2) while statement B “the use and analysis of facts and information in order to reach decisions” was most frequently rated higher in question 1. These differences in responses may occur because while question 1 allows respondents to rate their agreement to the degree to which each of the statements could be used to describe the process they used, question 2 forced them into choosing just one statement which meant they may have chosen the statement which is least demanding in labelling the type of process used. Therefore, the choice of statement in question 2 may not adequately represent the distinguishing features of the process used.

Group members' responses were compared with those of their facilitators, who were asked the same question in their questionnaire, to determine whether their responses
agreed. The comparison was carried out according to organization because the same process was used for each meeting within one organization. The table below shows the frequency counts for each statement.

<table>
<thead>
<tr>
<th>organization</th>
<th>facilitator’s response</th>
<th>group members’ responses</th>
<th>number of missing cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>D</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

As can be seen above, for organizations 2 and 4 the majority of group members rated statement C as the best description of the process, as does their facilitator, but there is no strong pattern to indicate that group members and their facilitators agree on the type of process they are using. The results were not tested statistically.

The researcher considers that questions 1 and 2 are difficult to respond to and the responses are difficult to analyze for the following reasons. The questions ask members for their *perceptions* of the type of meeting process used and so there are no right or wrong answers. However, members’ and facilitators’ perceptions were being translated into a definitive description of the type of process being used. This is inappropriate. It was, therefore, decided that the responses to questions 1 and 2 do not provide useful data pertaining to the construct under study. There is no strong evidence for retaining them in the questionnaire and therefore, questions 1 and 2 are removed from the revised members’ questionnaire and question 2 is removed from the facilitators’ form.

**Question 3a**

Question 3a was one of four questions which was to be used as a criterion variable (see chapter 5, section 5.4.3). It is useful if the responses to all four criteria questions are examined at this stage. The other criteria questions are 21a, 25a and 26a.
The frequencies of group members' responses to these four questions are shown below.

3a. How happy were you with the process you used in today's meeting?

<table>
<thead>
<tr>
<th></th>
<th>very unhappy</th>
<th>unhappy</th>
<th>neither happy nor unhappy</th>
<th>happy</th>
<th>very happy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total valid cases</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>missing cases</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unhappy</td>
<td>0</td>
<td>5 (9%)</td>
<td>7 (13%)</td>
<td>32 (59%)</td>
<td>11 (20%)</td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

21a. How happy were you with the decisions you made as a group?

<table>
<thead>
<tr>
<th></th>
<th>very unhappy</th>
<th>unhappy</th>
<th>neither happy nor unhappy</th>
<th>happy</th>
<th>very happy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total valid cases</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>missing cases</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>unhappy</td>
<td>0</td>
<td>2 (4%)</td>
<td>9 (16%)</td>
<td>36 (63%)</td>
<td>10 (18%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

25a. What is your overall level of satisfaction with the meeting process you as a group used today?

<table>
<thead>
<tr>
<th></th>
<th>strongly dissatisfied</th>
<th>dissatisfied</th>
<th>neither dissatisfied or satisfied</th>
<th>satisfied</th>
<th>strongly satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total valid cases</td>
<td>57</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>missing cases</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dissatisfied</td>
<td>0</td>
<td>3 (5%)</td>
<td>3 (5%)</td>
<td>36 (63%)</td>
<td>15 (26%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

26a. What is your overall level of satisfaction with the decisions you as a group made in the meeting?

<table>
<thead>
<tr>
<th></th>
<th>strongly dissatisfied</th>
<th>dissatisfied</th>
<th>neither dissatisfied or satisfied</th>
<th>satisfied</th>
<th>strongly satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total valid cases</td>
<td>55</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>missing cases</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dissatisfied</td>
<td>0</td>
<td>2 (4%)</td>
<td>6 (11%)</td>
<td>38 (70%)</td>
<td>9 (16%)</td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

Question 25a ("What is your overall level of satisfaction with the meeting process you as a group used today?") tries to assess the same construct as question 3a ("How
happy were you with the process you used?" in order to confirm members' responses to question 3a. A problem arises with trying to assess the same construct without repeating the question. It was anticipated that members' degree of happiness with the process (question 3a) would be rated similarly to their overall level of satisfaction with the process (question 25a). The responses show that while 22% rated themselves as very unhappy, unhappy or neither happy nor unhappy with the process (question 3a), 10% rated themselves as very dissatisfied, dissatisfied or neither satisfied or dissatisfied with the process (question 25a).

Similarly, question 26a ("What is your overall level of satisfaction with the decisions you as a group made in the meeting?") attempts to assess the same construct as question 21a ("How happy are you with the decisions you made?"). The responses show that while 20% rated themselves as very unhappy, unhappy or neither happy nor unhappy with the decisions (question 21a), 15% rated themselves as very dissatisfied, dissatisfied or neither satisfied or dissatisfied with the decisions (question 26a). Inspection of the frequency counts indicate that members are responding differently to questions 3a and 21a than to 25a and 26a. Fewer members rated their degree of overall satisfaction with the process and decisions as scale point "3" or less compared to the ratings of members' happiness with the process and decisions. This pattern of response may occur because members may be unhappy with certain aspects of the process or decisions, which is reflected in their rating of happiness with the process or decisions but, overall, they rate themselves as satisfied with the process and decisions. The responses to questions 3a and 21a suggest that question 3a is a slightly better discriminatory predictor of member's feelings towards the process than question 21a. Similarly, the responses to question 25a and 26a suggest that question 25a is a slightly better discriminatory predictor of member's feelings towards the decisions than question 26a. This suggests that questions 3a and 21a would be better at discriminating between those items in the questionnaire which resulted in members' happiness or unhappiness with the process and decisions. Taking these points into consideration, it was decided to use members' rated degree of happiness with the process (question 3a) and decisions (question 21a) as the two criteria variables against which to crosstabulate the responses to the other variables assessed in the questionnaire. If questions 25a and 26a are not needed as criteria questions they need
not be included in the revised version of the questionnaire. Questions 3a and 21a will be retained in the revised questionnaire to produce an overall rating of members' degree of happiness with the process and outcomes.

**Question 3b**

3b. Please give the reason(s) for your answer to 3a.

The purpose of question 3b was twofold. Firstly, it allowed the researcher to ascertain whether there were reasons for a group member's level of happiness with the process which had not been identified during the earlier questionnaire development stages. Secondly, open-ended questions allow respondents some degree of freedom of speech, as discussed in section 5.2.1.

The responses to question 3b were classified into nine categories. Negative reasons were classified into one category because individual answers emerged. The categories of responses and frequencies are given below. Some members gave more than one reason for their degree of happiness with the process.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Logical/ structured/ consistent approach</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>2</td>
<td>Group got a decision/ achieved objectives</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>Constructive/ cooperative/ non-confrontational approach</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Full discussions</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>Opportunity for all to participate</td>
<td>19</td>
<td>35</td>
</tr>
<tr>
<td>6</td>
<td>Innovative/ creative/ interesting approach</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Group achieved consensus</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>A fair approach</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>A negative reason</td>
<td>16</td>
<td>29</td>
</tr>
</tbody>
</table>

The above table shows that all the items, except item 8, were mentioned by approximately 5% or more of the sample. Item 5, “the opportunity for all group members to participate” is the most frequently cited reason for members' happiness
with the process. All the items mentioned by at least 5% of the sample are included elsewhere in the questionnaire and, therefore, do not need to be considered for inclusion in the revised version of the questionnaire.

Negative reasons for members' rated degree of happiness with the process included the comments given below.

1. Bias by majority interests and tampering of the model until it gave the answers people wanted.
2. Progress difficult and no meaningful decisions could be made due to a lack of information and ignorance of functions of other company divisions.
3. Insufficient time with certain aspects carefully avoided and some questions not effectively answered.
4. Problems took too long to discuss, the process did not make best use of the available information and opinions were subjective.
5. Having to make a choice which did not entirely follow from previous discussions.
6. The idea was good but it was not always possible to achieve.
7. No option on the process.

As all the positive reasons given by members for their degree of happiness with the process have been asked elsewhere in the questionnaire, it is only necessary to elicit negative reasons. Question 3b of the questionnaire shall be changed to ask members for their reasons for their answer to question 3a only if they rate their degree of happiness with the process as less than or equal to the scale rank of 3. The responses can then be used to aid the identification of recurring comments made about a particular process or meeting.

**Question 4**

Question 4 asked for members' agreement to three statements. Statement A will be considered separately and statements B and C considered together.
4a. Please indicate your level of agreement to the following statement.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A I think the process we used today helped the group focus on the key issues under discussion.</td>
<td>0 (3.6%)</td>
<td>2 (3.6%)</td>
<td>4 (7.3%)</td>
<td>33 (60.0%)</td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

**Criterion-related validity**

Members' rated degree of happiness with the process and their agreement to statement A were recoded, as described in section 7.1, and crosstabulated. The chi square statistic of independence was calculated as 14.940 which is significant at the 0.01 level. Thus, members' degree of happiness with the process is associated with whether the process helps the group focus on key issues under discussion. As a result, there is strong evidence for retaining this question in the revised version of the questionnaire.

Frequencies of responses to statements B and C of question 4a are shown below.

4a. Please indicate your level of agreement to the following 2 statements.

<table>
<thead>
<tr>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>B I felt the facilitator intervened frequently during the meeting.</td>
<td>3 (6%)</td>
<td>18 (33%)</td>
<td>18 (33%)</td>
<td>13 (24%)</td>
</tr>
<tr>
<td>C I think the facilitator should have intervened more frequently.</td>
<td>10 (19%)</td>
<td>32 (59%)</td>
<td>10 (19%)</td>
<td>2 (4%)</td>
</tr>
</tbody>
</table>

(Total valid cases 54; missing cases 3)

**Criterion-related validity**

Members’ responses to statements B and C were recoded and crosstabulated with members’ recoded responses of their degree of happiness with the process.
These results indicate that members' responses to "the frequency of facilitator interventions" (statement B) and "whether they thought the facilitator should have intervened more frequently" (statement C) were not significantly associated with members' degree of happiness with the process. Therefore, according to the assumptions in section 7.1, these results indicate strong evidence for removing statements B and C of question 4a from the questionnaire.

**Question 4b**

4b. Please give the reason(s) for your answer to statement C (I think the facilitator should have intervened more frequently):

The answers to this open-ended question have been classed into five categories. Negative reasons are classed into one category.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Need for support without control; importance of leading and not guiding</td>
<td>23</td>
<td>43</td>
</tr>
<tr>
<td>2</td>
<td>Maintaining flow of discussion</td>
<td>13</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>Balance between keeping discussions to the point and stifling debate</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>Need to keep to time constraints</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>A negative reason</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

(Total valid cases 54; missing cases 3)

Various negative reasons were given such as the facilitator did not know when to intervene, when a discussion was irrelevant or when a point had been made.
These responses were given as reasons for members' answers to statement C. However, it has already been indicated that members' rating of agreement to statement C ("I think the facilitator should have intervened more frequently") is not significantly associated with members' degree of happiness with the process and the statement was to be removed from the revised version of the questionnaire. Therefore, as a consequence, question 4b is no longer of relevance and will also be removed from the questionnaire.

Section B Members' feelings about the process

Question 5

This question asks members to rate their agreement to six statements (A to F) describing intangible benefits associated with GDSS use. Frequency counts of members' responses are shown below.

5. Please indicate your level of agreement to the following 6 statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A I feel that my ability to do my job has been enhanced.</td>
<td>1 (2%)</td>
<td>5 (9%)</td>
<td>36 (63%)</td>
<td>14 (25%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>B I feel that I have gained new insights and learning into the operations of the company.</td>
<td>1 (2%)</td>
<td>9 (16%)</td>
<td>21 (37%)</td>
<td>24 (42%)</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>C I feel that we as a group were able to make better, more informed decisions.</td>
<td>0 (0%)</td>
<td>3 (5%)</td>
<td>7 (12%)</td>
<td>36 (63%)</td>
<td>11 (19%)</td>
</tr>
<tr>
<td>D I feel that the discussions within the group were less emotive.</td>
<td>0 (0%)</td>
<td>13 (23%)</td>
<td>14 (25%)</td>
<td>30 (53%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>E I feel that the influence of individual group member's personalities upon discussions was decreased.</td>
<td>1 (2%)</td>
<td>12 (21%)</td>
<td>19 (33%)</td>
<td>23 (40%)</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>F I feel that my understanding of the general business environment in which my organization operates has increased.</td>
<td>2 (4%)</td>
<td>9 (16%)</td>
<td>26 (46%)</td>
<td>17 (30%)</td>
<td>3 (5%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

Reliability

The scale of statements A to F was assessed for reliability. Cronbach's Alpha was
calculated as 0.7738 which indicates that the scale shows an acceptable level of reliability. The results of the analysis are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>item to total correlation</th>
<th>alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.5152</td>
<td>.7435</td>
</tr>
<tr>
<td>B</td>
<td>.5964</td>
<td>.7196</td>
</tr>
<tr>
<td>C</td>
<td>.7471</td>
<td>.6869</td>
</tr>
<tr>
<td>D</td>
<td>.3042</td>
<td>.7928</td>
</tr>
<tr>
<td>E</td>
<td>.3620</td>
<td>.7830</td>
</tr>
<tr>
<td>F</td>
<td>.6631</td>
<td>.6995</td>
</tr>
</tbody>
</table>

Statement C, "I feel that we as a group were able to make better, more informed decisions" shows the highest item-total correlation while statement D, "I feel that the discussions within the group were less emotive" and E, "I feel that my understanding of the general business environment in which my organization operates has increased" showed the lowest item to total correlation. The significance of these results is discussed later.

**Criterion-related validity**

The members' responses to statements A to F were recoded and crosstabulated with members' rated degree of happiness with the process. The results of the analysis are shown in the table below.

<table>
<thead>
<tr>
<th>statement</th>
<th>chi square value</th>
<th>level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.76</td>
<td>b</td>
</tr>
<tr>
<td>B</td>
<td>8.53</td>
<td>a</td>
</tr>
<tr>
<td>C</td>
<td>33.31</td>
<td>a</td>
</tr>
<tr>
<td>D</td>
<td>4.73</td>
<td>b</td>
</tr>
<tr>
<td>E</td>
<td>8.53</td>
<td>a</td>
</tr>
<tr>
<td>F</td>
<td>7.47</td>
<td>b</td>
</tr>
</tbody>
</table>

(a and b represent significance at 0.01 and 0.05 levels respectively)
The analysis shows that all the crosstabulations were significant at the minimum level of 0.05. Therefore, members' responses to the six statements (A to F) comprising question 5 are all significantly associated with members' rated degree of happiness with the process. The variables upon which statements A to F are based are measuring some aspect of the construct "members' happiness with the process" and provide strong evidence for retention in the final version of the questionnaire.

**Construct validity**

A Principal Components Factor Analysis (PCFA) was carried out on the scale of statements A to F. The factors and the variance explained by each are shown below.

<table>
<thead>
<tr>
<th>factor</th>
<th>eigenvalue</th>
<th>% of variance explained</th>
<th>cumulative % of variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.98</td>
<td>49.7</td>
<td>49.7</td>
</tr>
<tr>
<td>2</td>
<td>1.19</td>
<td>19.8</td>
<td>69.5</td>
</tr>
<tr>
<td>3</td>
<td>.701</td>
<td>11.7</td>
<td>81.2</td>
</tr>
<tr>
<td>4</td>
<td>.630</td>
<td>10.5</td>
<td>91.7</td>
</tr>
<tr>
<td>5</td>
<td>.314</td>
<td>5.2</td>
<td>97.0</td>
</tr>
<tr>
<td>6</td>
<td>.181</td>
<td>3.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Using Everitt and Dunn's (1991) first two criteria for choosing the number of principal components (see section 7.1), examination of the above table would indicate that there are three principal components underlying the variance in scores. Factors 1, 2 and 3 have eigenvalues greater than 0.70 and these three factors would account for over 80% of the variance. However, examination of the scree plot below indicates that the selection of two factors is appropriate with the elbow in the line connecting the factors appearing at factor 3.
Thus, the PCFA extracted two factors. These two factors, which together account for 69.5% of the variation in scores (an acceptable percentage of variance), were rotated using the varimax technique so that each variable tends to load highly on to only one of the two factors. The resulting factor loadings for each variable, or statement A to F, are shown in the table below.

<table>
<thead>
<tr>
<th>scale statement</th>
<th>factor 1</th>
<th>factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.716</td>
<td>.129</td>
</tr>
<tr>
<td>B</td>
<td>.931</td>
<td>-.040</td>
</tr>
<tr>
<td>C</td>
<td>.706</td>
<td>.500</td>
</tr>
<tr>
<td>D</td>
<td>.071</td>
<td>.766</td>
</tr>
<tr>
<td>E</td>
<td>.134</td>
<td>.819</td>
</tr>
<tr>
<td>F</td>
<td>.846</td>
<td>.177</td>
</tr>
</tbody>
</table>
Using a factor loading of 0.4 or above as the cut-off point for assigning variables to factors (see section 7.1), examination of the above table shows that statements A “I feel my ability to do my job has been enhanced”, B “I feel that I have gained new insights and learning into the operations of the company” and F “I feel that my understanding of the general business environment in which my organization operates has increased” load most heavily onto factor 1. Statements D “I feel that the discussions were less emotive” and E “I feel that the influence of group member’s personalities upon discussions was decreased” load most heavily onto factor 2. Statement C “I feel that the group was able to make better, more informed decisions” loads onto both factors. Statements A, B and F are clearly associated as they are concerned with an improved ability to do one’s job and a greater understanding of the company and its operations. This factor will be called “organizational understanding”. Statements D and E of factor 2 are also clearly associated as they are both concerned with the subjectiveness and emotiveness of the process. This factor will be termed “emotiveness of process”. The value of Cronbach’s alpha indicated that statements D and E showed the lowest item to total correlation which further suggests that statements D and E are assessing some underlying aspect of intangible benefits, different from the aspects assessed by the remainder of the statements. Examination of statements A, B, D, E and F shows that a member’s high rating of these, that is, that members felt they learnt about the organization’s operations (factor 1) and that the process was less emotive (factor 2), should lead to an agreement that the group made better, more informed decisions. Thus, the fact that statement C “I feel that the group were able to make better, more informed decisions” loads on to both factors 1 and 2 is reasonable.

Thus, there are two factors underlying the scale of possible intangible benefits members can gain from using a GDSS.

**Factor 1 “Organizational understanding”** comprising:

A “I feel my ability to do my job has been enhanced”

B “I feel that I have gained new insights and learning into the operations of the company”

C “I feel that the group were able to make better, more informed decisions”
F "I feel that my understanding of the general business environment in which my organization operates has increased"

Factor 2 "Emotiveness of process" comprising:

C "I feel that the group were able to make better, more informed decisions"
D "I feel that the discussions were less emotive"
E "I feel that the influence of group member's personalities upon discussions was decreased".

In summary, because all the statements A to F were significantly associated with a members' rated degree of happiness with the process, they will all be retained in the revised questionnaire.

**Question 6a and 6b**

These two questions serve as a check on the validity of statements A to F in question 5 as measures of members' degree of happiness with the process. It was proposed that if members were asked which of the 6 statements A to F represents the most significant benefit they gained from using the GDSS and which they would most like to gain, a corresponding response to both questions should mean members rate their happiness with the process higher than if their responses to the two questions did not correspond. The tables below show a frequency count of respondents' answers.

6. Of the 6 statements (A-F) above:

a) which represents the most significant benefit you gained from using today's meeting process?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4 (7%)</td>
<td>5 (9%)</td>
<td>37 (66%)</td>
<td>2 (4%)</td>
<td>6 (11%)</td>
<td>2 (4%)</td>
</tr>
</tbody>
</table>

(Total valid cases 56; missing cases 1)
b) Which represents the benefit you would most like to gain from using a meeting process?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th></th>
<th>B</th>
<th></th>
<th>C</th>
<th></th>
<th>D</th>
<th></th>
<th>E</th>
<th></th>
<th>F</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>11 (20%)</td>
<td>1 (2%)</td>
<td>33 (60%)</td>
<td>1 (2%)</td>
<td>7 (13%)</td>
<td>2 (4%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

From these results it can be seen that the majority of members felt the most significant benefit they gained was to make better, more improved decisions (C) and this was also the benefit they would most like to gain.

The responses of those members who selected the same response to both question 6a and 6b were examined.

<table>
<thead>
<tr>
<th>statement chosen for 6a and 6b</th>
<th>frequency of response</th>
<th>percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>21</td>
<td>88</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

(Total valid cases 24; missing cases 0)

The rated degree of happiness with the process was then examined for this sample of 24 members and compared with the responses for the degree of happiness for the whole sample.
Chapter Seven: Results and Discussions

<table>
<thead>
<tr>
<th>scale points</th>
<th>frequencies of responses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>responses of sample of 24</td>
</tr>
<tr>
<td>very unhappy</td>
<td>0</td>
</tr>
<tr>
<td>unhappy</td>
<td>0</td>
</tr>
<tr>
<td>neither unhappy or happy</td>
<td>3 (13%)</td>
</tr>
<tr>
<td>happy</td>
<td>13 (57%)</td>
</tr>
<tr>
<td>very happy</td>
<td>7 (30%)</td>
</tr>
</tbody>
</table>

(Total valid cases 23; missing cases 1)

87% of those members who rated that the greatest benefit they gained from the process was the same benefit they would most like to gain, were either happy or very happy with the process compared with 79% of the total population of respondents. Thus, a slightly larger percentage of those members choosing the same response for question 6a and 6b are happy or very unhappy compared to the whole sample. However, the median rating of members’ happiness with the process for each sample was “happy”. Questions 6a and 6b do not appear to provide additional results which have not already been gathered from the questionnaire. As there is no strong evidence for retaining these question in the questionnaire, it was decided that they would not be included in the revised version.

Question 7

7. Please list any other benefit(s) you felt you gained from using today’s meeting process.

Members’ responses to this open-ended question were categorized into five classes.
Of the five categories of response, two were mentioned by at least 5% of the sample, that is, item 1, “better use of limited time” and item 3 “improved group working”. These items will be considered at the end of the chapter in section 7.3. As the purpose of question 7 was to check the development of the questionnaire and this has been achieved, question 7 will be removed from the revised version of the questionnaire.

**Section C Member’s attitude to the decisions made**

**Question 8**

This question asks members to rate their agreement to five statements (A to E) describing group member’s attitudes towards the decisions made. The frequency of responses is shown below.

8. Please answer the following questions.

<table>
<thead>
<tr>
<th>Compared to your feelings from previous meetings, how has using today’s meeting process influenced your ...</th>
<th>greatly decreased</th>
<th>somewhat decreased</th>
<th>made no difference</th>
<th>somewhat increased</th>
<th>greatly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A acceptance of the decisions made?</td>
<td>0</td>
<td>1</td>
<td>24</td>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>B understanding of the decisions made?</td>
<td>0</td>
<td>0</td>
<td>19</td>
<td>29</td>
<td>8</td>
</tr>
<tr>
<td>C confidence in the decisions made?</td>
<td>0</td>
<td>3</td>
<td>17</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>D feelings of ownership for the decisions made?</td>
<td>1</td>
<td>1</td>
<td>17</td>
<td>30</td>
<td>7</td>
</tr>
<tr>
<td>E commitment to implementing the decisions made?</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>18</td>
<td>10</td>
</tr>
</tbody>
</table>

(Total valid cases 56; missing cases 1)
Reliability

The scale of statements A to E was assessed for reliability. Cronbach’s alpha was calculated as 0.8381 which represents an acceptable level of reliability. The results of the analysis are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>item to total correlation</th>
<th>alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.6169</td>
<td>0.8153</td>
</tr>
<tr>
<td>B</td>
<td>0.5624</td>
<td>0.8258</td>
</tr>
<tr>
<td>C</td>
<td>0.6579</td>
<td>0.8006</td>
</tr>
<tr>
<td>D</td>
<td>0.6548</td>
<td>0.8023</td>
</tr>
<tr>
<td>E</td>
<td>0.7320</td>
<td>0.7783</td>
</tr>
</tbody>
</table>

Statement E, “commitment to the decisions made” showed the highest item-total correlation while statement B, “understanding of the decisions made” was shown to be the least reliable item on the scale. The significance of this is discussed later.

Criterion-related validity

Members’ recoded responses to statements A to E were crosstabulated with members’ recoded responses of their degree of happiness with the process. The responses were crosstabulated with members’ happiness with the process as opposed to happiness with the decisions. This is appropriate because the question asked respondents how they felt the process had influenced their feelings towards the decisions. The results are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>chi square value</th>
<th>level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>6.627</td>
<td>a</td>
</tr>
<tr>
<td>B</td>
<td>1.929</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>17.357</td>
<td>a</td>
</tr>
<tr>
<td>D</td>
<td>8.855</td>
<td>a</td>
</tr>
<tr>
<td>E</td>
<td>11.704</td>
<td>a</td>
</tr>
</tbody>
</table>

(a and b represent significance at 0.01 and 0.05 levels respectively)
The results show that statements A, “acceptance of the decisions made”, C, “confidence in the decisions made”, D, “feelings of ownership for the decisions made” and E “commitment to the decisions made” were significantly associated with group members’ rated degree of happiness with the process while statement B “understanding of the decisions made” did not show any such association.

Construct validity

A PCFA was carried out on the scale comprised of statements A to E. The results are shown below.

<table>
<thead>
<tr>
<th>factor</th>
<th>eigenvalue</th>
<th>% of variance explained</th>
<th>cumulative % of variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.054</td>
<td>61.1</td>
<td>61.1</td>
</tr>
<tr>
<td>2</td>
<td>.752</td>
<td>15.1</td>
<td>76.1</td>
</tr>
<tr>
<td>3</td>
<td>.525</td>
<td>10.5</td>
<td>86.6</td>
</tr>
<tr>
<td>4</td>
<td>.380</td>
<td>7.6</td>
<td>94.3</td>
</tr>
<tr>
<td>5</td>
<td>.287</td>
<td>5.7</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Using two of Everitt and Dunn’s (1991) criteria that the number of principal components to be chosen should explain around 70% of the total variance in scores and that it is reasonable to include any components whose eigenvalues are greater than 0.7, it may be expected that two factors should be retained from this PCFA by examining the above table. However, examination of the scree plot indicates that only one factor should be retained.
That only one factor was extracted is as expected because the five statements comprising the scale are all concerned with member's feelings towards the decisions reached as a result of using a particular process. As only one factor was extracted the solution could not be rotated. Although this one factor accounts for 61% of the total variance as opposed to the 70% suggested desirable by Dunn and Everitt (1991), the evidence of the scree plot clearly indicates extracting one factor.

The analysis of criterion-related validity indicated that statement B, "understanding of the decisions made" was not significantly associated with members' rated degree of happiness with the process. This result provides strong evidence for removing this statement from the revised version of the questionnaire.

Questions 9a and 9b

These questions serve a similar purpose to questions 6a and 6b. Members were asked which of the five statements A to E above best represents the greatest change in their
feelings with respect to the decisions made and which statement represents the most important feeling they would like to have towards the decisions made. If their answers to the two questions corresponded, this implies they should be happy with the process. The tables below show a frequency count of respondents’ answers.

9. Of the 5 statements (A-E) above:
a) which represents the greatest change in your feelings towards today’s decisions as a result of using today’s meeting process?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>no change</th>
</tr>
</thead>
<tbody>
<tr>
<td>9%</td>
<td>5</td>
<td>13</td>
<td>19</td>
<td>9</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>

(Total valid cases 53; missing cases 4)

b) which represents the most important feeling you would like to have towards the decisions made in a meeting?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>6%</td>
<td>3</td>
<td>5</td>
<td>18</td>
<td>9</td>
<td>19</td>
</tr>
</tbody>
</table>

(Total valid cases 53; missing cases 4)

The greatest change in feelings group members’ experienced was in respect of statement C, “confidence in the decisions made”, while the most important feeling members would like to gain was statement E, “commitment to the decisions made”.

Those members whose answers to 9a and 9b corresponded were selected and their responses are shown below.
The degree of happiness with the process for this sample of 14 members was examined and compared with the degree of happiness of the whole sample population.

<table>
<thead>
<tr>
<th>scale points</th>
<th>frequencies of responses (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>responses of sample of 14</td>
</tr>
<tr>
<td>very unhappy</td>
<td>0</td>
</tr>
<tr>
<td>unhappy</td>
<td>1 (8%)</td>
</tr>
<tr>
<td>neither unhappy or happy</td>
<td>0</td>
</tr>
<tr>
<td>happy</td>
<td>9 (69%)</td>
</tr>
<tr>
<td>very happy</td>
<td>3 (23%)</td>
</tr>
</tbody>
</table>

(Total valid cases 14; missing cases 1)

92% of those members who responded that the feeling they would most like to gain towards the decisions (question 9a) was the feeling they thought it was most important to gain (question 9b) were happy or very happy with the process. This compares with 79% of the whole sample who were happy or very happy with the process. Thus, a slightly larger percentage of those members choosing the same statement both for questions 9a and 9b are happy or very unhappy compared to the whole sample. However, the median rating of members' happiness with the process for each sample was "happy". This demonstrates that questions 9a and 9b do not
provide additional results which have not already been gathered from the questionnaire. There is no strong evidence for retaining these question in the questionnaire and therefore, it was decided that they would not be included in the revised version.

**Question 10**

10. Please list any other benefit(s) you gained from using today’s meeting process with respect to the decisions made.

Group members' responses to this question were categorized into four classes as shown below.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group responsibility for decisions</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Less emotive/ more logical and reasoned process</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Generated insight into problems</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>4</td>
<td>Improved own decision -making ability</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Of the four classes of responses, only item 3, "generated insight into problems" was mentioned by at least 5% of the sample. Therefore, this item will be considered in section 7.3 of this chapter.

Question 10 has now served its purpose of checking the development of the questionnaire and can, therefore, be removed from the revised version of the questionnaire.

**Section D Effects of the process on the group**

**Question 11**

This question asks members to rate their agreement to four statements A to D describing the effects of using GDSS on feelings within the group. A frequency count of responses is shown below.
11. Please answer the following questions.

<table>
<thead>
<tr>
<th>Compared to previous meetings you have participated in, how has using today's meeting process influenced ...</th>
<th>greatly decreased</th>
<th>somewhat decreased</th>
<th>made no difference</th>
<th>somewhat increased</th>
<th>greatly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A your willingness to work with the group again?</td>
<td>0 (4%)</td>
<td>2 (65%)</td>
<td>37 (23%)</td>
<td>13 (9%)</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>B the feeling of teamwork within the group?</td>
<td>0 (7%)</td>
<td>4 (46%)</td>
<td>19 (33%)</td>
<td>26 (14%)</td>
<td>8 (9%)</td>
</tr>
<tr>
<td>C the feeling of pleasantness and agreeableness within the group?</td>
<td>0 (7%)</td>
<td>4 (44%)</td>
<td>25 (40%)</td>
<td>23 (9%)</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>D the feeling of group spirit within the group?</td>
<td>0 (9%)</td>
<td>5 (42%)</td>
<td>24 (39%)</td>
<td>22 (11%)</td>
<td>6 (11%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

Reliability

Reliability of the scale A to D was assessed. Cronbach’s coefficient alpha was calculated as 0.9197. Thus, the scale shows a high level of reliability. The results of the analysis are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>item to total correlation</th>
<th>alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.8116</td>
<td>.8987</td>
</tr>
<tr>
<td>B</td>
<td>.8180</td>
<td>.8953</td>
</tr>
<tr>
<td>C</td>
<td>.7899</td>
<td>.9040</td>
</tr>
<tr>
<td>D</td>
<td>.8492</td>
<td>.8839</td>
</tr>
</tbody>
</table>

Criterion-related validity

Members’ responses to statements A to D were recoded and crosstabulated with members’ recoded responses of happiness with the process. The results of the analysis are shown below.
The results show that the scale statements A, "willingness to work with the group again", C, "the feelings of pleasantness and agreeableness within the group" and D, "the feeling of group spirit within the group" were significantly associated with members' degree of happiness with the process at the minimum level of significance of 0.05. Statement B, "the feeling of teamwork within the group" was not significantly associated with members' degree of happiness with the process.

**Construct validity**

A PCFA was performed on the scale statements A to D. The results are shown below.

<table>
<thead>
<tr>
<th>factor</th>
<th>eigenvalue</th>
<th>% of variance explained</th>
<th>cumulative % of variance explained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.232</td>
<td>80.8</td>
<td>80.8</td>
</tr>
<tr>
<td>2</td>
<td>.294</td>
<td>7.4</td>
<td>88.1</td>
</tr>
<tr>
<td>3</td>
<td>.273</td>
<td>6.8</td>
<td>95.0</td>
</tr>
<tr>
<td>4</td>
<td>.201</td>
<td>5.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

The above analysis shows that one factor accounts for 80.8% of the total variation and only one factor has an eigenvalue greater than 0.7. Examination of the scree plot confirms that the variance in scores is explained by one underlying factor.
As only one factor was extracted, the solution could not be rotated. It is expected that only one factor can be extracted from the PCFA because the statements A to D, that is, A, "willingness to work with the group again", B, "the feeling of teamwork within the group", C, "the feelings of pleasantness and agreeableness within the group" and D, "the feeling of group spirit within the group" are concerned with members' feelings towards the group.

In review, criterion-related validity found statement B, "the feeling of teamwork within the group" not to be significantly associated with group member's degree of happiness with the process. Therefore, strong evidence is provided for removing this statement from question 11 in the revised version of the questionnaire.

Question 12a and 12b

These questions serve a similar purpose to questions 6a and 6b and to 9a and 9b. If members were asked which of the four statements A to D above in question 11
represents their greatest change in feelings with respect to the group (question 12a) and which they would most like (question 12b), then if their answers corresponded, they should be happy with the process. The tables below show a frequency count of respondents’ answers.

12. Of the 4 statements (A-D) above, in your view:
   a) which represents the greatest change in group feelings as a result of using today's meeting process?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>no change</th>
</tr>
</thead>
<tbody>
<tr>
<td>count</td>
<td>6 (12%)</td>
<td>29 (57%)</td>
<td>9 (18%)</td>
<td>6 (12%)</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>

(Total valid cases 51; missing values 6)

b) which represents the most important feeling the group should gain as a result of using a meeting process?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>count</td>
<td>7 (7%)</td>
<td>39 (71%)</td>
<td>2 (4%)</td>
<td>10 (18%)</td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

The majority of group members felt that statement B “feelings of teamwork within the group” represented the greatest change as a result of using the GDSS (question 12a) and this was the feeling most members wished to gain from using the process (question 12b).

The responses of those members who chose the same statement for questions 12a and 12b are shown below.

<table>
<thead>
<tr>
<th>statement chosen for 12a and 12b</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>B</td>
<td>24</td>
<td>80%</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>10%</td>
</tr>
</tbody>
</table>

(Total valid cases 30)
The degree of happiness with the process for these members was examined and compared to the degree of happiness of the whole sample population.

<table>
<thead>
<tr>
<th>scale points</th>
<th>frequencies of responses (%)</th>
<th>responses of sample of 30</th>
<th>responses of whole sample of 57</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unhappy</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>unhappy</td>
<td></td>
<td>4 (13%)</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>neither unhappy or happy</td>
<td></td>
<td>4 (13%)</td>
<td>7 (13%)</td>
</tr>
<tr>
<td>happy</td>
<td></td>
<td>16 (53%)</td>
<td>32 (59%)</td>
</tr>
<tr>
<td>very happy</td>
<td></td>
<td>6 (20%)</td>
<td>11 (20%)</td>
</tr>
</tbody>
</table>

(Total valid cases 30; missing cases 0)

73% of those members who said the feeling they most wanted to gain towards the group as a result of using the process (question 12a) was also the one most important to them to gain (question 12b), were either happy or very happy with the process. These results compare with 79% of the whole sample who were happy or very happy with the process. Thus, a slightly larger percentage of those members choosing the same statement both for questions 12a and 12b are happy or very unhappy compared to the whole sample. The median rating of members’ happiness with the process for each sample was “happy”. It is felt that, as with questions 6a and 6b and 9a and 9b, questions 12a and 12b do not provide additional results which have not already been gathered from the questionnaire. There is no strong evidence for retaining these questions in the questionnaire and they will, therefore, be removed from the revised version of the questionnaire.

**Question 13**

13. Please list any other factor(s) concerning the group which you felt were influenced as a result of using today’s meeting process?

The responses to this question have been categorized into five classes as shown below.
Chapter Seven: Results and Discussions

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Laid foundations for future decision making</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>More widespread contributions</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Fresh approach/ improved group working</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Willingness to listen to others</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Greater understanding of others member’s jobs</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

None of the five items were mentioned by at least 5% of the sample. Therefore, no items need to be set aside to considered later and as this question had served its purpose both of allowing members some degree of freedom of speech and of checking the development of the questionnaire, it was decided that this question would be removed from the revised version of the questionnaire.

Section E Assessing the process

Question 14

14. Please compare today's meeting with a conventional meeting (one not supported by a designed process and facilitator) and then rate today's meeting according to the statements below.

<table>
<thead>
<tr>
<th></th>
<th>much less than conventional meeting</th>
<th>a little less than conventional meeting</th>
<th>no different from conventional meeting</th>
<th>a little greater than conventional meeting</th>
<th>much greater than conventional meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Time taken to reach decision.</td>
<td>9 (16%)</td>
<td>13 (23%)</td>
<td>4 (7%)</td>
<td>12 (21%)</td>
<td>18 (32%)</td>
</tr>
<tr>
<td>B Percentage of total group members participating in discussions.</td>
<td>0 (2%)</td>
<td>18 (32%)</td>
<td>17 (30%)</td>
<td>20 (36%)</td>
<td></td>
</tr>
<tr>
<td>C Opportunity for group members to participate in discussions.</td>
<td>1 (2%)</td>
<td>0 (32%)</td>
<td>18 (26%)</td>
<td>15 (29%)</td>
<td>22 (39%)</td>
</tr>
<tr>
<td>D Number of alternative decisions considered.</td>
<td>1 (2%)</td>
<td>2 (4%)</td>
<td>5 (9%)</td>
<td>22 (39%)</td>
<td>26 (46%)</td>
</tr>
<tr>
<td>E Number of criteria used to evaluate the alternative decisions.</td>
<td>0 (6%)</td>
<td>3 (22%)</td>
<td>12 (16%)</td>
<td>9 (15%)</td>
<td>31 (56%)</td>
</tr>
<tr>
<td>F The number of ideas generated by the group.</td>
<td>1 (2%)</td>
<td>4 (7%)</td>
<td>6 (11%)</td>
<td>27 (48%)</td>
<td>18 (32%)</td>
</tr>
</tbody>
</table>

(Total valid cases 56; missing cases 1)
Reliability

Reliability of the scale A to F was assessed. Cronbach's alpha was calculated as 0.6359 and therefore, the scale shows a rather low level of reliability. The results of the analysis are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>item to total correlation</th>
<th>alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.1262</td>
<td>.7392</td>
</tr>
<tr>
<td>B</td>
<td>.4375</td>
<td>.5728</td>
</tr>
<tr>
<td>C</td>
<td>.4144</td>
<td>.5771</td>
</tr>
<tr>
<td>D</td>
<td>.4688</td>
<td>.5613</td>
</tr>
<tr>
<td>E</td>
<td>.5361</td>
<td>.5303</td>
</tr>
<tr>
<td>F</td>
<td>.4252</td>
<td>.5729</td>
</tr>
</tbody>
</table>

It can be seen that statement A, "time taken to reach a decision" has a very low item to total correlation of 0.1262. The low reliability of item A is reasonable because the question asks members to compare the amount of time taken in today's meeting with a conventional meeting. This is a difficult question to assess for reliability, as the use of a GDSS may speed up the process for some tasks while for other tasks it may prolong the process. Therefore, a variety of responses may be expected from group members. Calculation of Cronbach's alpha is based on comparing the scores on each individual item with the total scores from the other items. Therefore, if scores on statement A are likely to vary, then the reliability will be lower. However, if statement A is set aside temporarily, the reliability of the statements B to F is 0.7392 which is an acceptable level of reliability. Therefore, while statement A makes it difficult to assess the reliability of the scale, it is reasonable to expect this and the statement should not be removed from the questionnaire.

Criterion-related validity

The members' responses to items A to F were recoded and crosstabulated with members' rated degree of happiness with the process. The results are shown below.
The results show that statements B, “percentage of group members participating in discussions”, C, “opportunity for group members to participate in discussions” and F, “number of ideas generated by the group” were significantly associated with members’ degree of happiness with the process at the minimum level of significance of 0.05. The problem highlighted above concerning statement A may be the cause of this item not being significantly associated with happiness with the process. Statements D, “number of alternative decisions considered” and E, “number of criteria used to evaluate decisions” are not significantly associated with members’ happiness with the process.

Construct validity

A PCFA was performed on the scale items A to F. The resulting factors and the variance explained by each are shown below.

<table>
<thead>
<tr>
<th>factor</th>
<th>eigenvalue</th>
<th>% of variance explained</th>
<th>cumulative % of variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.485</td>
<td>41.4</td>
<td>41.4</td>
</tr>
<tr>
<td>2</td>
<td>1.400</td>
<td>23.3</td>
<td>64.8</td>
</tr>
<tr>
<td>3</td>
<td>.947</td>
<td>15.8</td>
<td>80.5</td>
</tr>
<tr>
<td>4</td>
<td>.742</td>
<td>12.4</td>
<td>92.9</td>
</tr>
<tr>
<td>5</td>
<td>.281</td>
<td>4.7</td>
<td>97.6</td>
</tr>
<tr>
<td>6</td>
<td>.144</td>
<td>2.4</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Chapter Seven: Results and Discussions

These results indicate the presence of 3 or 4 principal components as 4 factors have eigenvalues greater than 0.7 and 3 factors would account for 80.5% in the variation of scores. The scree plot associated with these factors is difficult to interpret as an "elbow" is not apparent and hence the number of principal factors is not clearly indicated.

Factor 1 accounts for 41.4% of the variance in scores, factor 2 for 23.3% and factors 3 and 4 accounting for 15.8% and 12.4% respectively. Therefore, according to the first of Everitt and Dunn's (1991) rules for choosing the number of factors, factor 3 represents the point at which progressively smaller gains in variance are achieved indicating that two factors should be extracted. Factors 1 and 2 account for a total of 64.7% of the variance in scores and they both have eigenvalues greater than 1. It was decided that the extraction of two factors would be investigated. The two factors were rotated using the varimax technique. The resulting factor matrix is shown below.
Examination of the above table shows that statements B, "percentage of group members participating in discussions", and C, "opportunity for group members to participate in discussions" load most heavily onto factor 1. These two statements are concerned with aspects of participation by group members in the discussions and therefore this factor will be named "participation in discussions". Items A, "time taken to reach decisions", D, "number of alternative decisions considered", E, "number of criteria used to evaluate decisions" and F, "number of ideas generated by the group", load most heavily onto factor 2. These items are concerned with quantitative aspects of the process such as the number of ideas generated and the number of decisions considered. This factor will be called "quantitative measures of the process". The extraction of two factors and the subsequent loading of the variables on each factor is reasonable. Thus, it is concluded that there are two factors underlying the scale which assesses the process as shown below.

**Factor 1 “Participation in discussions”** comprising:
- B, “percentage of group members participating in discussions”
- C, “opportunity for group members to participate in discussions”

**Factor 2 “Quantitative measures of the process”** comprising:
- A, “time taken to reach decisions”
- D, “number of alternative decisions considered”
- E, “number of criteria used to evaluate decisions”
- F, “number of ideas generated by the group”

<table>
<thead>
<tr>
<th>scale statements</th>
<th>factor 1</th>
<th>factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.215</td>
<td>.506</td>
</tr>
<tr>
<td>B</td>
<td>.919</td>
<td>.061</td>
</tr>
<tr>
<td>C</td>
<td>.919</td>
<td>.103</td>
</tr>
<tr>
<td>D</td>
<td>.324</td>
<td>.717</td>
</tr>
<tr>
<td>E</td>
<td>.075</td>
<td>.904</td>
</tr>
<tr>
<td>F</td>
<td>.358</td>
<td>.558</td>
</tr>
</tbody>
</table>
Chapter Seven: Results and Discussions

In summary, two factors were found to underly the scale of statements A to F. However, the assessment of criterion-related validity found that statements D and E were not significantly associated with members' degree of happiness with the process. Therefore, the tests for criterion-related validity provide strong evidence for removing statements D and E from the revised version of the questionnaire.

Question 15

This question asks members to state which of the 6 statements, A to F, of question 14 represents the greatest difference between the GDSS supported meeting and a conventional meeting.

15. Of the 6 statements (A-F) above please indicate which you feel represents the greatest difference between today's meeting and a conventional meeting, that is, one not supported by a designed process and facilitator.

<table>
<thead>
<tr>
<th>statement chosen</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>C</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>D</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>E</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>F</td>
<td>9</td>
<td>16</td>
</tr>
</tbody>
</table>

(Total valid cases 55; missing cases 2)

Statement D, “the number of alternative decisions considered” was most frequently chosen as the statement which represents the greatest difference between the GDSS supported meeting and a conventional meeting. The analysis of question 14 found this factor not to be significantly associated with members’ happiness with the process. The responses to question 15 will be considered with question 17.

Question 16

This question asks group members to rate the importance of each of the aspects
covered in the statements A to F of question 14.

16. This question asks you to indicate your agreement to a number of statements relating to meetings in general and not specifically to today's meeting process.

<table>
<thead>
<tr>
<th>In my view it is important in decision-making meetings that...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A the group takes as little time as possible to reach decisions.</td>
<td>14 (25%)</td>
<td>24 (42%)</td>
<td>12 (21%)</td>
<td>7 (12%)</td>
<td>0</td>
</tr>
<tr>
<td>B a large percentage of group members contribute to the discussions.</td>
<td>0</td>
<td>3 (5%)</td>
<td>4 (7%)</td>
<td>30 (53%)</td>
<td>20 (35%)</td>
</tr>
<tr>
<td>C all group members are given an equal opportunity to participate in discussions.</td>
<td>0</td>
<td>2 (4%)</td>
<td>1 (2%)</td>
<td>22 (39%)</td>
<td>32 (56%)</td>
</tr>
<tr>
<td>D the group considers a large number of alternative decisions.</td>
<td>1 (2%)</td>
<td>8 (14%)</td>
<td>15 (27%)</td>
<td>26 (46%)</td>
<td>6 (11%)</td>
</tr>
<tr>
<td>E the group evaluates the alternative decisions using a large number of criteria.</td>
<td>1 (2%)</td>
<td>8 (14%)</td>
<td>23 (40%)</td>
<td>20 (35%)</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>F the group generates a large number of ideas.</td>
<td>0</td>
<td>7 (12%)</td>
<td>8 (14%)</td>
<td>37 (65%)</td>
<td>5 (9%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

It can be seen that the majority of members did not feel it was important for decision-making meetings to take as little time as possible (statement A). This question shows an inverse rating compared to the other variables in question 16 which gives credence to the fact that members were responding to the questions and not arbitrarily marking down one side of the rating scales. The possibility of this problem arising was discussed in section 5.2.1. The frequencies also show that 95% of members agreed or strongly agreed that statement C, “all group members are given an opportunity to participate” was important in decision making meetings. The second most highly rated feature of decision making meetings was item B, “a large percentage of members contribute to the discussions”. Statements D, “the group considers a large number of alternative decisions” and E, “the group evaluates the alternative decisions using a large number of criteria” were rated as the least important features of decision-making meetings. These results support the findings of question 14 namely that items B, “a large percentage of members contribute to the discussions” and C, “all group members are given an opportunity to participate” are important features of
members' degree of happiness with the process and that statements D, "the group considers a large number of alternative decisions" and E, "the group evaluates the alternative decisions using a large number of criteria" are not associated with members' degree of happiness with the process.

The results of the analyses for question 16 confirm the decisions made concerning the removal of statements D and E of question 14 from the revised questionnaire. Question 16 may be removed completely as its purpose was to check the development of the questionnaire by confirming members' responses to question 14.

Question 17

This question asked group members to assess which of the statements A to F of question 16 they felt it was most important to attain from using a meeting process.

17. Of the 6 statements (A-F) above which do you think it is most important to attain from using a meeting process?

<table>
<thead>
<tr>
<th>statement chosen</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>C</td>
<td>21</td>
<td>40</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>E</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>

(Total valid cases 53; missing cases 4)

Question 15 asked members which of the statements A to F represented the greatest difference between today's meeting and a conventional meeting. Those members who selected the same statement for both question 15 and 17 were selected. Their responses are shown below.
The degree of happiness with the process was examined for this sample and compared with the degree of happiness for the whole sample population.

<table>
<thead>
<tr>
<th>scale points</th>
<th>frequencies of responses (%)</th>
<th>responses of sample of 36</th>
<th>responses of whole sample of 57</th>
</tr>
</thead>
<tbody>
<tr>
<td>very unhappy</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>unhappy</td>
<td>5 (14%)</td>
<td>5 (9%)</td>
<td></td>
</tr>
<tr>
<td>neither unhappy or happy</td>
<td>4 (11%)</td>
<td>7 (13%)</td>
<td></td>
</tr>
<tr>
<td>happy</td>
<td>20 (56%)</td>
<td>32 (59%)</td>
<td></td>
</tr>
<tr>
<td>very happy</td>
<td>7 (19%)</td>
<td>11 (20%)</td>
<td></td>
</tr>
</tbody>
</table>

75% of those members whose answers to question 15 and 17 corresponded were happy or very happy with the process compared to 79% of the whole sample population. Therefore, the members in the selected sample of 37 do not appear to be more happy with the process than those in the whole sample. There is no strong evidence for retaining questions 15 and 17 in the questionnaire and therefore, they will be removed from the revised version of the questionnaire.
Question 18a

This question asks members to rate their agreement to seven further statements concerned with aspects of the process. Frequency counts of responses are shown below.

18a. Please indicate your level of agreement to the following 7 statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Using today’s meeting process heightened my interest in the meeting.</td>
<td>0</td>
<td>4 (7%)</td>
<td>21 (37%)</td>
<td>28 (49%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>B The group reached a high degree of consensus.</td>
<td>0</td>
<td>6 (11%)</td>
<td>7 (12%)</td>
<td>35 (61%)</td>
<td>9 (16%)</td>
</tr>
<tr>
<td>C The meeting process we used today helped the group to reach consensus on the decisions.</td>
<td>0</td>
<td>1 (2%)</td>
<td>9 (16%)</td>
<td>34 (60%)</td>
<td>13 (23%)</td>
</tr>
<tr>
<td>D I have a strong interest in the issues under discussion.</td>
<td>0</td>
<td>1 (2%)</td>
<td>1 (2%)</td>
<td>26 (46%)</td>
<td>29 (51%)</td>
</tr>
<tr>
<td>E Today’s meeting process made the meeting more entertaining.</td>
<td>2 (4%)</td>
<td>4 (7%)</td>
<td>15 (27%)</td>
<td>24 (43%)</td>
<td>11 (20%)</td>
</tr>
<tr>
<td>F The meeting process we used today helped the group build commitment to implementing the decisions made.</td>
<td>1 (2%)</td>
<td>4 (7%)</td>
<td>13 (23%)</td>
<td>29 (51%)</td>
<td>10 (18%)</td>
</tr>
<tr>
<td>G I found today’s meeting process novel.</td>
<td>2 (4%)</td>
<td>14 (25%)</td>
<td>26 (46%)</td>
<td>13 (23%)</td>
<td>2 (4%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

Reliability

The reliability of the scale A to G was assessed. Cronbach’s alpha was calculated to be 0.7662 which indicates that the scale shows an acceptable level of reliability. The results of the analysis are shown below.
Seven: Results and Discussions

<table>
<thead>
<tr>
<th>statement</th>
<th>item to total correlation</th>
<th>alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.5537</td>
<td>.7248</td>
</tr>
<tr>
<td>B</td>
<td>.6262</td>
<td>.7063</td>
</tr>
<tr>
<td>C</td>
<td>.6009</td>
<td>.7188</td>
</tr>
<tr>
<td>D</td>
<td>.2447</td>
<td>.7770</td>
</tr>
<tr>
<td>E</td>
<td>.4329</td>
<td>.7548</td>
</tr>
<tr>
<td>F</td>
<td>.5536</td>
<td>.7222</td>
</tr>
<tr>
<td>G</td>
<td>.4329</td>
<td>.7497</td>
</tr>
</tbody>
</table>

Statement B, "the group reached a high degree of consensus" shows the highest item-scale correlation while item D, "I have a strong interest in the issues under discussion" has the lowest item-scale correlation.

**Criterion-related validity**

The members responses to statements A to G were recoded, as previously described in section 7.1 and crosstabulated with members' rated degree of happiness with the process. The results are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>chi square value</th>
<th>level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3.310</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>25.449</td>
<td>a</td>
</tr>
<tr>
<td>C</td>
<td>19.755</td>
<td>a</td>
</tr>
<tr>
<td>D</td>
<td>.284</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>2.641</td>
<td>-</td>
</tr>
<tr>
<td>F</td>
<td>13.972</td>
<td>a</td>
</tr>
<tr>
<td>G</td>
<td>2.776</td>
<td>-</td>
</tr>
</tbody>
</table>

(a and b represent significance at 0.01 and 0.05 levels respectively)

The results show that items B, "the group reached a high degree of consensus", C, "the meeting process we used today helped the group reach consensus on the decisions" and F, "the meeting process we used today helped the group build
commitment to implementing the decisions made” are significantly associated with members’ degree of happiness with the process at the minimum level of significance of 0.05.

Construct validity

A PCFA was carried out on the scale of statements A to G. The resulting factors and the variance explained by each are presented below.

<table>
<thead>
<tr>
<th>factor</th>
<th>eigenvalue</th>
<th>% of variance explained</th>
<th>cumulative % of variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.022</td>
<td>43.2%</td>
<td>43.2%</td>
</tr>
<tr>
<td>2</td>
<td>1.039</td>
<td>14.8%</td>
<td>58.0%</td>
</tr>
<tr>
<td>3</td>
<td>0.967</td>
<td>13.8%</td>
<td>71.8%</td>
</tr>
<tr>
<td>4</td>
<td>0.797</td>
<td>11.4%</td>
<td>83.2%</td>
</tr>
<tr>
<td>5</td>
<td>0.480</td>
<td>6.9%</td>
<td>90.0%</td>
</tr>
<tr>
<td>6</td>
<td>0.375</td>
<td>5.4%</td>
<td>95.4%</td>
</tr>
<tr>
<td>7</td>
<td>0.321</td>
<td>4.6%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

According to Everitt and Dunn’s (1991) criteria, examination of the above table indicates the possibility of four principal components as four factors have eigenvalues greater than 0.7 and they account for 83.2% of the variation in scores. However, examination of the scree plot indicates only one underlying factor.
This one factor accounts for only 43.2% of the variation which is rather low (Everitt and Dunn, 1991). Therefore, two factors were examined and rotated using the varimax technique. The loadings of each variable on the factors are shown below.

<table>
<thead>
<tr>
<th>scale statements</th>
<th>factor 1</th>
<th>factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.107</td>
<td>.877</td>
</tr>
<tr>
<td>B</td>
<td>.751</td>
<td>.335</td>
</tr>
<tr>
<td>C</td>
<td>.800</td>
<td>.255</td>
</tr>
<tr>
<td>D</td>
<td>.178</td>
<td>.339</td>
</tr>
<tr>
<td>E</td>
<td>.206</td>
<td>.656</td>
</tr>
<tr>
<td>F</td>
<td>.884</td>
<td>.123</td>
</tr>
<tr>
<td>G</td>
<td>.203</td>
<td>.664</td>
</tr>
</tbody>
</table>

Examination of the above table reveals that statements B, “the group reached a high
degree of consensus”, C, “the meeting process used helped the group reach consensus on the decisions” and F, “the meeting process helped the group build commitment to implementing the decisions” load most heavily onto factor 1. These items are concerned with consensus and commitment of group members to the decisions and will be called “consensus and commitment”. Statements A, “today’s meeting process heightened my interest in the meeting”, E, “today’s meeting process made the meeting more entertaining” and G, “I found today’s meeting process novel” load most heavily onto factor 2. These are concerned with the “entertainment of the process” and this is the name given to factor 2. Statement D, “I have a strong interest in the issues under discussion” does not load heavily onto either factor. Thus, the two factors examined were:

**Factor 1 “consensus and commitment”** comprising:

B, “the group reached a high degree of consensus”

C, “the meeting process used helped the group reach consensus on the decisions”

F, “the meeting process helped the group build commitment to implementing the decisions”

**Factor 2 “entertainment of the process”** comprising:

A, “today’s meeting process heightened my interest in the meeting”

E, “today’s meeting process made the meeting more entertaining”

G, “I found today’s meeting process novel”

However, it had already been shown that statements A, D, E and G were not significantly associated with members’ degree of happiness with the process. PCFA indicated that statements A, E and G are all concerned with the “entertainment of the process” and therefore, it can be concluded that entertainment of the process is not significantly associated with members’ degree of happiness with the process. Thus, the results of the tests for criterion-related validity and factor analysis provide strong evidence for removing statements A, D, E and G from the questionnaire; these statements will not be included in the revised version. Doing this would leave just those three statements B, C and F which comprise Factor 1 which will be retained in the revised questionnaire. Therefore, the fact that the scree plot indicates only one
Chapter Seven: Results and Discussions

factor is reasonable. As only one factor was extracted it could not be rotated. The one factor underlying the scale above for assessing the process is as detailed below.

Factor 1 “consensus and commitment” comprising:

B, “the group reached a high degree of consensus”
C, “the meeting process used helped the group reach consensus on the decisions”
F, “the meeting process helped the group build commitment to implementing the decisions”.

Question 18b

This question is an extension of statement G of the previous question. It asks that if members’ rated the process as novel, did they find the novelty of the process distracted their attention from the issues under discussion, or did it stimulate their interest in the meeting?

18b. If you circled 4 or 5 to statement G, then please indicate your level of agreement to the following 2 statements, otherwise please go on to section F.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I found that the novelty of the process distracted my attention from the issues under discussion.</td>
<td>6 (40%)</td>
<td>5 (39%)</td>
<td>2 (15%)</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>I found that the novelty of the process stimulated my interest in the meeting.</td>
<td>0</td>
<td>0</td>
<td>3 (20%)</td>
<td>9 (60%)</td>
</tr>
</tbody>
</table>

(A: Total valid cases 13; missing cases 2  B: Total valid cases 15; missing cases 2)

These results show that of those members who found the meeting process novel, that is, they rated agreement to statement G as greater than 3, the majority found it stimulated their interest in the meeting as opposed to distracting their attention.

As respondents have inversely rated their agreement to statements A and B of question 18b, this pattern of responses demonstrates again that respondents read the questions and did not merely mark their answers without due consideration.
Criterion-related validity

By recoding members' responses to statement A, "I found the novelty of the process distracted my attention from the issues under discussion", all the responses fell into the same category because all members rated their agreement as scale points 1, 2 or 3. Clearly, therefore, statement A is not associated with members' degree of happiness with the process.

Members' responses to statement B "I found the novelty of the process stimulated my interest in the meeting" were recoded and crosstabulated against members' degree of happiness with the process. The chi square statistic of independence was calculated as 1.465 which is not statistically significant. Therefore, the novelty of the process stimulating members' interest in the meeting is not significantly associated with members' degree of happiness with the process. This is supported by the fact that in question 18a, statements concerning the novelty and entertainment of the process were also found not to be significantly associated with members' happiness with the process. These results provide strong evidence for removing statements A and B of question 18b from the revised version of the questionnaire.

Section F  Characteristics of the decisions made

Question 19 and 20

The responses to questions 19 and 20 are considered together. These questions aim to assess whether members were able to identify the type of decisions made. Respondents were asked to rate their agreement to four statements describing the decisions reached. Statements A to D of question 19 were based on the four criteria used to assess the "ends achieved by the decision-making process" as described by McCartt and Rohrbaugh (1989). The statements were carefully worded in an endeavour to capture the essence of McCartt and Rohrbaugh (1989) four criteria. The frequency of responses are shown below.
19. Please indicate your level of agreement to the following 4 statements.

<table>
<thead>
<tr>
<th>The decisions we made as a group ...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A are legitimate and fair decisions which will be acceptable to those outside the meeting who will be affected by the decisions.</td>
<td>0 (0%)</td>
<td>5 (9%)</td>
<td>9 (16%)</td>
<td>38 (67%)</td>
<td>5 (9%)</td>
</tr>
<tr>
<td>B can be fully accounted for by the facts and information used to make the decisions.</td>
<td>0 (0%)</td>
<td>5 (9%)</td>
<td>8 (14%)</td>
<td>35 (61%)</td>
<td>9 (16%)</td>
</tr>
<tr>
<td>C are fully supported by the group as a whole.</td>
<td>1 (2%)</td>
<td>6 (11%)</td>
<td>10 (18%)</td>
<td>32 (56%)</td>
<td>8 (14%)</td>
</tr>
<tr>
<td>D are rational decisions which take into account organizational goals and objectives.</td>
<td>1 (2%)</td>
<td>3 (5%)</td>
<td>6 (11%)</td>
<td>34 (60%)</td>
<td>13 (23%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

20. Which of the 4 statements (A-D) above do you think best describes the decisions the group made today?

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 (21%)</td>
<td>12 (21%)</td>
<td>11 (19%)</td>
<td>22 (39%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

The results show that respondents felt that statement D, "the decisions are rational which take into account organizational goals and objectives" was the best description of the decisions they reached (question 20) and this was the statement rated higher most frequently in question 19.

Group members’ responses to question 20 ("which of the statements (A-D) above best describes the decisions the group made?") were compared with those of their facilitator, who was asked the same question in the facilitator's form, to determine if their responses agreed. This comparison was based on the premise that the facilitator, as the expert, would be the most able at identifying the type of decisions reached. The comparison was carried out according to organization because the same process was used for each meeting within one organization. The table below shows the frequency counts for each statement.
For organizations 2 to 4, the majority of group members within each organization chose the same statement as the facilitator, but there is no strong pattern to indicate that group members and their facilitators agree on the type of decisions reached using the process.

It was felt that, as with questions 1 and 2, questions 19 and 20 were difficult answers to respond to and also to analyze the results. This is because the questions are asking members for their perceptions of the type of decisions reached for which there are no right or wrong answers. However, members' and facilitators' perceptions were being used to produce a definitive description of the nature of decisions reached. This is inappropriate. It therefore, appears that questions 19 and 20 do not provide data that is of particular use to the construct under investigation. There is no strong evidence for retaining them in the questionnaire and thus, questions 19 and 20 will be removed from the revised members' questionnaire and question 20 will be removed from the facilitators' form.

Question 21a

This question asked members to rate their degree of happiness with the decisions reached and is a criterion question as described and analyzed under question 3a.

Question 21b

The purpose of question 21b is twofold, as for question 3b. Firstly, it allowed the researcher to ascertain whether there were reasons for a group member's degree of happiness with the decisions which had not been identified during the questionnaire

<table>
<thead>
<tr>
<th>organization</th>
<th>facilitator's response</th>
<th>group members' responses</th>
<th>number of missing cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>1</td>
<td>B</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>D</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>D</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
development stages. Secondly, the use of open-ended questions allows the researcher to gain greater insight into members' perceptions of the meetings and lets members explain their experiences in their own words.

The responses to question 21b were classified into nine categories. Negative reasons were categorized into one category as a variety of individual answers emerged. The frequencies of responses to question 21b are given below.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group responsibility for decisions</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>2</td>
<td>Group consensus on decisions</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Objective/ reasoned/ accountable methodology</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>Decisions were reached</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>5</td>
<td>Provided insights, identified challenges, clarified strengths and weaknesses</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Much discussion, debate and consideration of alternatives</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>Got lots done, group felt they had done a good job</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Right people making the decision</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>Negative reason</td>
<td>12</td>
<td>21</td>
</tr>
</tbody>
</table>

All the items were mentioned by at least 5% of the sample. Item 3, "gaining consensus on the decisions" is the most frequently cited reason for members' degree of happiness with the decisions. Of the items, only item 1, "group responsibility for decisions" and item 8, "right people making the decisions" have not been covered elsewhere in the questionnaire; these will be considered in section 7.3.

A variety of negative reasons was given, several of which are presented below.

1. Very few, if any, decisions were taken. One implied decision was made by dictate and not as a result of discussion.
2. Reached a decision through the process but very much at the Chief Executive Officer's say so.
3. A choice was made, for expediency, which did not necessarily follow from the
discussions in the first part of the meeting.

4. A final model has not been produced as yet so my degree of happiness with the decisions is uncertain.

5. An inconsistent use of criteria, bias by majority interests and tampering with the model until it gave the answers people wanted rather than necessarily the correct answers. The process was not allowed to run properly for various reasons concerning the vested interests of persons inside and outside the group.

6. Insufficient time was given to the complete process and thus some matters which should have been discussed were not and I have the feeling that certain aspects were carefully avoided and some questions not effectively answered.

7. The process did not make best use of the available information on the diverse range of budget heads. No strategic view was expressed and opinions tended to be subjective. The preliminaries took too long leaving insufficient time to review and refine the options.

8. My neutral feelings arise from the feeling of exhaustion at the end of the process counterbalanced by the feeling of achievement.

9. The idea was good but it was not always possible to achieve.

As all the positive reasons given by members for their degree of happiness with the decisions have been asked elsewhere in the questionnaire, it was decided that question 21b of the questionnaire should be changed to ask members for their reasons for their answer to question 21a if they rate their degree of happiness with the decisions as less than or equal to the scale rank of "3". This was to identify if there were any recurring comments made about a particular process or meeting which could be rectified.

**Question 22**

This question asked respondents to rate their agreement to six further statements, A to F, concerned with the decisions reached in the meeting. Group members responses are shown below.
22. Please indicate your level of agreement to the following 6 statements.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>0</td>
<td>9 (16%)</td>
<td>44 (77%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>0</td>
<td>9 (16%)</td>
<td>44 (77%)</td>
<td>4 (7%)</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
<td>13 (23%)</td>
<td>37 (65%)</td>
<td>7 (12%)</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>4 (7%)</td>
<td>8 (14%)</td>
<td>33 (58%)</td>
<td>12 (21%)</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>3 (5%)</td>
<td>2 (4%)</td>
<td>40 (70%)</td>
<td>12 (21%)</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>0</td>
<td>13 (23%)</td>
<td>33 (58%)</td>
<td>11 (19%)</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

Reliability

The scale of statements A to F was assessed for reliability. Cronbach’s alpha was calculated as 0.7651 which indicates an acceptable level of reliability. The results of the analysis are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>item to total correlation</th>
<th>alpha if item deleted</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.5920</td>
<td>.7188</td>
</tr>
<tr>
<td>B</td>
<td>.3203</td>
<td>.7709</td>
</tr>
<tr>
<td>C</td>
<td>.4345</td>
<td>.7486</td>
</tr>
<tr>
<td>D</td>
<td>.6170</td>
<td>.7016</td>
</tr>
<tr>
<td>E</td>
<td>.6550</td>
<td>.6877</td>
</tr>
<tr>
<td>F</td>
<td>.4751</td>
<td>.7398</td>
</tr>
</tbody>
</table>

Statement E, “the group is committed to implementing the decisions” show the highest item to total correlation while item B, “the decisions can be practically implemented” has the smallest item to total correlation.
## Criterion-related validity

Members’ responses to statements A to F were recoded and crosstabulated with members’ recoded responses to degree of happiness with the decisions. The results are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>chi square value</th>
<th>level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9.021</td>
<td>a</td>
</tr>
<tr>
<td>B</td>
<td>.460</td>
<td>-</td>
</tr>
<tr>
<td>C</td>
<td>19.294</td>
<td>a</td>
</tr>
<tr>
<td>D</td>
<td>9.200</td>
<td>a</td>
</tr>
<tr>
<td>E</td>
<td>5.30</td>
<td>b</td>
</tr>
<tr>
<td>F</td>
<td>7.800</td>
<td>a</td>
</tr>
</tbody>
</table>

(a and b represent significance at 0.01 and 0.05 levels respectively)

The results show that all the statements A to F, except B, “the decisions can be practically implemented“, are significantly associated with members’ degree of happiness with the decisions at the minimum level of significance of 0.05.

## Construct validity

A PCFA was carried out on the statements A to F. The resulting factors and the variance explained by each are shown below.

<table>
<thead>
<tr>
<th>factor</th>
<th>eigenvalue</th>
<th>% of variance explained</th>
<th>cumulative % of variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.820</td>
<td>47.0</td>
<td>47.0</td>
</tr>
<tr>
<td>2</td>
<td>.980</td>
<td>16.3</td>
<td>63.3</td>
</tr>
<tr>
<td>3</td>
<td>.745</td>
<td>12.4</td>
<td>75.5</td>
</tr>
<tr>
<td>4</td>
<td>.637</td>
<td>10.6</td>
<td>86.3</td>
</tr>
<tr>
<td>5</td>
<td>.550</td>
<td>9.2</td>
<td>95.5</td>
</tr>
<tr>
<td>6</td>
<td>.269</td>
<td>4.5</td>
<td>100.0</td>
</tr>
</tbody>
</table>

According to Everitt and Dunn’s (1991) criteria, examination of the above table would indicate retaining three principal factors whose eigenvalues are greater than 0.7
and which together account for 75.7% of the variation in scores. The scree plot representing the factors and eigenvalues is shown below.

Interpretation of the scree plot is not straightforward. Factors 3, 4 and 5 are joined by a line of approximately equal gradient, indicating that they each account for progressively smaller increases in variance in scores while factors 2 and 3 are joined by a line of slightly steeper gradient, indicating that factor 2 accounts for a slightly greater percentage of variance in scores than factors 3, 4 and 5. Furthermore, as factors 1 and 2 would account for 63.3% of the total variance in scores and both have eigenvalues greater than 1, it is prudent to investigate extracting two factors. The two extracted factors were rotated using the varimax technique. The loadings of the statements on each factor are shown below.
Examination of the above table reveals that statements A, “the decisions made are effective decisions”, D, “the group made good, quality decisions in terms of the amount of time spent reaching the decisions” and E, “the meeting was productive” load most heavily on to factor 1. These items are concerned with the “quality of the decisions made” and this is the name given to factor 1. Statements B, “the decisions can be practically implemented” and C, “implementing the decisions made will bring about the changes intended” load most heavily on to factor 2 and are concerned with the “implementation of decisions”. This is the name given to factor 2. Statement F, “the group is committed to implementing the decisions made” loads on to both factors. This is as may be expected because a group’s commitment to implementing the decisions may be enhanced by certain features of the decisions such as their quality (factor 1) but is also an aspect of implementing decisions (factor 2). Thus, when two factors were investigated the following was revealed.

**Factor 1 “quality of the decisions made” comprising:**

- A “the decisions made are effective decisions”
- D “the group made good, quality decisions in terms of the amount of time spent reaching the decisions”
- E “the meeting was productive”
- F “quality of the decisions made”.

**Factor 2 “implementation of decisions” comprising:**

- B “the decisions can be practically implemented”
- C “implementing the decisions made will bring about the changes intended”
F "quality of the decisions made"

These results obtained by investigating the extraction of two factors using PCFA seem reasonable. It was, therefore, decided to retain these two factors as detailed above.

From the tests for criterion-related validity, statement B, "the decisions can be practically implemented" was found not to be significantly associated with members' rated degree of happiness with the decisions and therefore, there is strong evidence for removing this statement from the revised version of the questionnaire. The remaining statements will be retained.

Question 23

23. To what extent did the group achieve its objectives?

<table>
<thead>
<tr>
<th></th>
<th>not at all</th>
<th>to a minor extent</th>
<th>to a major extent</th>
<th>fully</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (2%)</td>
<td>4 (7%)</td>
<td>34 (61%)</td>
<td>17 (30%)</td>
<td></td>
</tr>
</tbody>
</table>

(Total valid cases 56; missing cases 1)

Criterion-related validity

Group members' responses of "not at all" and "to minor extent" were recoded as "1" and the responses "to a major extent" and "fully" as "2". These recoded responses were then crosstabulated with members’ recoded degree of happiness with the process. The chi square statistic of independence was calculated as 4.701, which is significant at the 0.05 level. Hence, the degree of achievement of objectives is significantly associated with members' happiness with the process. This provides strong evidence for retaining this question in the revised version of the questionnaire.

Section G Overall feelings of satisfaction

Question 24

This question asked members to rate their agreement to three further statements
Chapter Seven: Results and Discussions

describing the process and decisions. Frequency counts of responses are presented below.

24. Please indicate your level of agreement to the following 3 statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>neither agree nor disagree</th>
<th>Disagree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A The process we used a group today to make decisions made sense.</td>
<td>35</td>
<td>16</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>B The decisions we made as a group made sense.</td>
<td>41</td>
<td>11</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>C I would like to use the meeting process we used in a future meeting.</td>
<td>31</td>
<td>15</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

(Total valid cases 56; missing cases 1)

Criterion-related validity

Members’ responses to question 24 were recoded and crosstabulated with members’ recoded ratings of degree of happiness either with the decision or the process, as appropriate. Statements A, “the process used to make decisions made sense” and C, “I would like to use the process in a future meeting” are concerned with the process and therefore the responses were crosstabulated with members’ happiness with the process. Statement B, “the decisions made sense” is concerned with the decisions and consequently, members’ responses were crosstabulated with members’ happiness with the decisions. The results are shown below.

<table>
<thead>
<tr>
<th>statement</th>
<th>chi square value</th>
<th>level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.701</td>
<td>b</td>
</tr>
<tr>
<td>B</td>
<td>9.589</td>
<td>a</td>
</tr>
<tr>
<td>C</td>
<td>5.691</td>
<td>b</td>
</tr>
</tbody>
</table>

(a and b represent significance at 0.01 and 0.05 levels respectively)

The results show that statements A, “the process used to make decisions made sense”, and C, “I would like to use the process in a future meeting”, are significantly
associated with members’ happiness with the process while item B, “the decisions made sense”, is significantly associated with members’ happiness with the decisions. All are significant at the minimum level of significance of 0.05. Therefore, these statements are criterion-related valid and will be retained in the questionnaire.

**Question 25a**

This question asked members to rate their overall level of satisfaction with the process and is a criterion question as described under question 3a. Members’ responses to this question were investigated under the analysis of responses to question 3a.

**Question 25b**

25b. What gave you most satisfaction from using the meeting process?

The purpose of question 25b is twofold as for question 3b and 21b. The use of such open-ended questions has been described previously (see question 3b). Responses were classified into nine categories. Frequencies of responses are shown below.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A structured, logical process</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>2</td>
<td>Achieved objectives, reached decisions</td>
<td>9</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Opportunity to contribute to debate</td>
<td>26</td>
<td>47</td>
</tr>
<tr>
<td>4</td>
<td>Creative process, encouraged lateral thinking</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Inability of few to dominate process</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Efficiency of process</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Got consensus</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>8</td>
<td>Views challenged in a controlled way</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>Seeing the process in action</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

All the items, except 8 and 9, were mentioned by at least 5% of the population. Item 3, “opportunity to contribute to debate” was the most frequently cited reason for members’ satisfaction with the process. Of the items mentioned by at least 5% of the
sample, only item 6, "efficiency of process" had not been covered elsewhere in the questionnaire. This will be considered in section 7.3.

As other questions asking members for their reasons for degree of happiness with the process are to be removed from the revised version of the questionnaire, it is appropriate to allow members some degree of free expression to say what they liked about the process and to identify any recurring comments made by group members which may be particular to one meeting. It was, therefore, decided to retain this question in the revised form of the questionnaire but to change the wording to "what did you like most about the process?".

**Question 25c**

25c. What did you not like about the meeting process?

Responses to this question were classed into six categories as shown below.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Discussion dominated/ stifled by some members</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Concentration on form to exclusion of substance, leading not guiding</td>
<td>12</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>Time constraints</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Bogged down at times, items took too long to explore, discussions off the point</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Process tiring</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Lack of understanding by members, not enough information</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Items 1 and 2 were mentioned by at least 5% of the sample. Item 1 is covered elsewhere in the questionnaire. Item 2, "concentration on the form of the process at the exclusion of the meeting content" will be considered in section 7.3.

It was decided to retain question 25c in the revised form of the questionnaire to allow respondents some degree of free expression about what they did not like about the process and to identify any recurring comments made by group members which may
be particular to one meeting. The wording of the question was not changed.

**Question 26a**

This question asks members to rate their overall level of satisfaction with the decisions reached and is a criterion question as described under question 3a. Members’ responses to this question were provided under the analysis of responses to question 3a.

**Question 26b**

26b. What satisfied you most about the decisions the group made?

Members’ responses to this question were classified into nine categories. Frequencies of responses are given below.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quality of decisions</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>2</td>
<td>Decisions were reached</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>Decisions reflect shared inputs</td>
<td>19</td>
<td>34</td>
</tr>
<tr>
<td>4</td>
<td>Practical decisions made, can be implemented</td>
<td>7</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Strategic, thought-through, logical process lead to relevant decisions</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Consensus on decisions</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>Intuitively comfortable with decisions, right decisions for the group at this time</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Appropriate people present</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>Mutual understanding</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

All the items, except items 7 and 9, were mentioned by at least 5% of the sample. Of the items mentioned by at least 5% of the sample, only item 8 has not been covered elsewhere in the questionnaire and will be considered further in section 7.3.

Once again it was decided to retain this question in the revised form of the
questionnaire to allow respondents some degree of free expression as this will be the only opportunity members have for giving their reasons why they liked the decisions. The wording of the question has changed to “what did you like about the decisions made?”

Question 26c

26c. What did you not like about the decisions the group made?

Members’ responses to this question were classified into six groups.

<table>
<thead>
<tr>
<th>item</th>
<th>category</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Not full commitment by members to decisions</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>Decisions dominated by some members</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Limited choice made which did not follow fully from discussions</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>4</td>
<td>Decisions theoretically correct but can they be practically implemented</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Appropriate people absent</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Not full understanding of issues by members</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

The frequencies of response show that items 1, 2 and 3 were mentioned by at least 5% of the sample. Item 1, “degree of commitment” and item 2, “decision dominated by some” are covered elsewhere in the questionnaire. Therefore, only item 3, ”a choice was made which did not follow fully from the discussions” needs to be considered further in section 7.3.

Once again it was decided to retain this question in the revised form of the questionnaire to allow respondents some degree of free expression for their reasons for dislike of the decisions made.

Question 27

27. Including today, how many times have you attended a meeting which has used the same meeting process as the group used today?
Chapter Seven: Results and Discussions

<table>
<thead>
<tr>
<th>number of times</th>
<th>frequency of response</th>
<th>percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>3-5</td>
<td>22</td>
<td>39</td>
</tr>
<tr>
<td>6-10</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>11-20</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>20+</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

**Criterion-related validity**

For this question it was difficult to decide how to recode the categories above into a two-category response. Category “1-2” represents new users of the GDSS who may be unaware of its benefits and disadvantages. Category “3-5” represents those users who have had a little more experience of the GDSS supported process and are beginning to feel familiar with the process. Category “6-10” represents experienced users who are able to define its benefits and pitfalls. Categories “11-20” and “20+” represent users who have had a great deal of experience of meetings and may now play down both the benefits and disadvantages of the process. Quite different statistical results could emerge by recoding these categories of responses in different ways. It may be possible to reduce the number of categories of responses to three, but the statistical confidence in the results will not be sufficient with a sample size of 57. It was, therefore, decided that members’ recoded responses of their degree of happiness with the process would be examined for each category. Members’ degree of happiness with the process has been recoded as described in section 7.1 with scale points “1”, “2” and “3” recoded as “1” and scale points “4” and “5” recoded as “2”. The results are shown in the table below where percentages represent column percentages.
An inspection of these results indicates that of those members who had used the process six times or more, all except one was either happy or very happy with the process. These results suggest that the greater the number of times a member has used the process the more likely they are to be happy with the process. However, the statistical significance of these results has not been tested for the reasons given above. Thus, there is no strong evidence that the number of times a member has used a process is significantly associated with their happiness with the process and hence there is no strong evidence for retaining this question in the questionnaire. It will, therefore, be removed from the revised version of the questionnaire.

**Question 28**

28. Including today, how many times have you attended a meeting which has used some sort of designed meeting process?

The responses to this question were coded into the same five categories as used for the previous question.
Chapter Seven: Results and Discussions

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>number of times</td>
<td>frequency of response</td>
<td>percentage (%)</td>
</tr>
<tr>
<td>1-2</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>3-5</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>6-10</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>11-20</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>20+</td>
<td>14</td>
<td>25</td>
</tr>
</tbody>
</table>

(Total valid cases 57; missing cases 0)

Criterion-related validity

As for question 27, the difficulty arose with this question as to how to recode the categories above into a two-category response. Therefore, it was decided to examine members' recoded responses of their degree of happiness with the process for each category. Members' degree of happiness with the process was recoded with scale points “1”, “2” and “3” recoded as “1” and scale points “4” and “5” recoded as “2”. The results are shown in the table below where percentages represent column percentages.

| number of times members have attended meeting using any process | members' recoded responses to degree of happiness with the process |
|---|---|---|
| 1-2 | 1 (8%) | 5 (12%) |
| 3-5 | 5 (42%) | 10 (23%) |
| 6-10 | 4 (33%) | 11 (26%) |
| 11-19 | 1 (8%) | 5 (12%) |
| 20 | 1 (8%) | 12 (28%) |

(Total valid cases 57; missing cases 0)

An inspection of these responses indicate that of 19 group members who had used some type of process, all but two were either happy or very happy with today's
process. These results have not been tested statistically. Thus, there is no strong
evidence that the number of times a member has used any process is significantly
associated with their happiness with today's process and so there is no strong
evidence for retaining this question in the questionnaire. It will, therefore, be removed
from the revised version of the questionnaire.

7.3 Open-ended responses

Those items that have been identified from the open-ended questions as being
mentioned by at least 5% of the sample and which are not covered in the
questionnaire will now be examined. The particular items and the questions to which
they refer are listed below.

Question 7
Item 1 “better use of limited time”
Item 3 “improved group working”

Question 10
Item 3 “generated insight into problems”

Question 21b
Item 1 “group responsibility for decisions”
Item 8 “right people making the decisions”

Question 25a
Item 6 “efficiency of process”

Question 25c
Item 2 “concentration on the form of the process at the exclusion of the meeting
content”
Chapter Seven: Results and Discussions

Question 26b
Item 8 “appropriate people present”

Question 26c
Item 3 “a choice was made which did not follow fully from the discussions”

There is a total of nine items mentioned by at least 5% of the sample which have not been included in the questionnaire. However, item 1 of question 7 “better use of limited time” and item 6 of question 25a, “efficiency of process” are both concerned with the efficiency of the process. Furthermore, item 8 of question 21b, “right people making the decision” and item 8 of question 26b, “appropriate people present” are concerned with the appropriateness of the membership of the decision-making group. Therefore, this reduces the number of items to seven. These items cannot be incorporated into the revised version of the questionnaire, as it stands, because it could jeopardize the known validity and reliability of the revised questionnaire (Appendix Six). However, each of the seven items will now be considered and suggestions will be made as to their wording and to where they would be inserted into the questionnaire. Appendix Seven presents the questionnaire which includes these items.

1. Improved group working.
This item is most appropriately placed in Section D, Effects of the process on the group.
“Compared to previous meetings you have participated in, how has using today’s meeting process influenced the ability of the group members to work together as a group?”

2. Generated insight into problems.
It is most appropriate for this item to be placed in Section E, Assessing the process.
“Please indicate your agreement to the following statement: The meeting process we used today helped to generate insight into the problems.”
3. **Group responsibility for decisions.**

   It is most appropriate for this item to be placed in Section E, Assessing the process.
   
   “Please indicate your agreement to the following statement: The meeting process we used today helped to build group responsibility for the decisions.”

4. **Efficiency of process.**

   It is most appropriate for this item to be placed in Section E, Assessing the process.
   
   “Please indicate your agreement to the following statement: Today’s meeting process made efficient use of the time available.”

5. **Concentration on the form of the process at the exclusion of the meeting content.**

   It is most appropriate for this item to be placed in Section E, Assessing the process.
   
   “Please indicate your agreement to the following statement: Today’s meeting process concentrated too much on the form of the process at the exclusion of the meeting content.”

6. **Appropriate people making the decisions.**

   It is most appropriate for this item to be placed in Section F, Characteristics of the decisions made.
   
   “Please indicate your agreement to the following statement: The people present in the meeting, were the appropriate ones to make the decisions.”

7. **A choice was made which did not follow fully from the discussions.**

   It is most appropriate for this item to be placed in Section F, Characteristics of the decisions made.
   
   “Please indicate your agreement to the following statement: Choices were made in the meeting which did not fully follow from the meeting discussions.”

The above questions have not been checked for validity and reliability. An assessment of a version of the questionnaire including these questions could form further work (see Chapter Eight).
Review

This chapter has presented the analyses carried out to test the questionnaire for validity and reliability. As a result of these analyses, revisions to the questionnaire are proposed. The revised and valid version of the questionnaire is presented in Appendix Six.
Chapter Eight

Conclusions

and

Recommendations

for Future Work
8.1 Conclusions

This thesis has described how the aims set out in Chapter One have been met. The principal conclusions of the work are listed below.

1. From the literature, those variables that are important in characterizing a group process supported by either a manual or IT-based GDSS have been identified. The literature search entailed an in-depth review of topics such as group communication, group and task behaviour, group processes and organizational behaviour. GDSS studies were also examined. As a result, the significant variables have been used to produce a framework for GDSS research which aims to model the process of a group engaged in cooperative work activities (see Chapter Six and Appendix One). Chapter Four showed that while a number of researchers had used a research framework to guide their studies, there existed no standard framework to promote the comparison of study results and the efficient interpretation of results and conclusions. Moreover, existing frameworks were found to be deficient in respect of those GDSS not IT-based.

2. The research framework has been examined by 11 GDSS experts who judged the framework on its content validity (see Chapter Five). Their affirmations meant that the framework can, therefore, be said to have content validity.

3. From the research framework a questionnaire was developed which aims to assess group members' perceptions of a meeting process and its outcomes when using a GDSS to support their co-operative work activities (see Appendix Two).

4. The questionnaire was assessed for reliability and validity using the data from real groups attending real meetings who completed the questionnaire. Chapter Four argued that in order to establish the external validity of the results, it is necessary to assess the questionnaire with such groups.

5. As a result of the statistical tests carried out, a revised version of the questionnaire has been developed which has been tested for validity and reliability (see Appendix
Six. The questionnaire has been tested for reliability and validity using four groups using three different types of GDSS under the conditions described in the meeting descriptions (Appendix Four). If the questionnaire is used in different group situations its validity and reliability will be reduced. Chapters Five and Seven described the tests for reliability and content, construct and criterion-related validity for which the questionnaire was tested. Such a questionnaire is not available from the literature (Chapter Four). This questionnaire can now be used by GDSS researchers in future meetings in order to assess group members’ perceptions of the meeting process and its outcomes. As the questionnaire has been verified for reliability and validity, the results produced can be used to compare reliably the merits of different process methods.

GDSS are still in relatively early stages of development. Researchers are keen to determine how the use of GDSS impact the group process. There are many opportunities for research in this area and the framework developed in this current work can be used by researchers to design studies by identifying hypotheses and variables to study, as an aid for discussing and interpreting results and for drawing conclusions and comparisons with previous research, while the questionnaire can be used as a means of evaluating GDSS.

8.2 Recommendations for future work

The work carried out in this research offers a springboard for much research using both the framework and the questionnaire. Listed below are some suggestions for future work focussing on further testing of the framework and questionnaire in contexts similar to those used in the current research.

1. The framework has been tested for content validity by the judgement of experts (see Chapter Five). However, these experts were predominantly involved with GDSS in which IT plays only a supplementary rôle to the skills of the facilitator or is absent. Therefore, the content validity of the framework could be tested further by asking for the opinions of a greater number of experts in the field, particularly of those in the US where IT frequently plays a central rôle in GDSS.
2. The questionnaire has been tested with three types of GDSS, one which is entirely manual, one which uses a computer to produce a hard copy of the ideas generated by the group for group members to take with them when they leave the meeting and one which uses a computer for modelling the decision process. These three systems do not cover the whole spectrum of GDSS and further research should be undertaken using the questionnaire with groups supported by a wider range of GDSS.

3. The questionnaire developed in this research was intended for use by managers using GDSS (see section 4.9.6). Different versions of the questionnaire could be developed from the framework by changing the wording of questions to suit other users of GDSS. These versions of the questionnaire could then undergo the tests for validity and reliability described in this current work.

4. In section 7.3, items were identified from the responses given by members to the open-ended questions which had not been asked in the questionnaire and these items were developed into potential questions. Suitable questions to which these items should be added were identified. Future research should carry out further tests for validity and reliability with these new items added to the revised version of the questionnaire.

5. In the questionnaire tested in this current work, problems arose with trying to assess McCarrt and Rohrbaugh's (1989) criteria which provide a standard for the process used and decisions reached. The questionnaire developed in this research attempted to assess each of the eight criteria succinctly by developing one question to assess each criteria. This was done in an effort to avoid a lengthy questionnaire. However, the responses to these questions were difficult to assess in the light of the nature of this questionnaire. Further work should attempt to find alternative methods for assessing these criteria conducive to the type of questionnaire developed in this research.

6. Validation of a measuring instrument is an on-going process with each stage producing more precise refinements. The revised version of the questionnaire represents a valid and reliable questionnaire. However, because of the nature of
validation, this version of the questionnaire could still benefit from further testing for validity and reliability now that its form has changed.

7. The validated questionnaire presented in Appendix Six contains those variables of a group process and its outcomes which have been found to be significantly associated with members’ degree of happiness with the process and decisions. The next stage would be to test the questionnaire in order to be able to give a weighting to each of these variables so that those variables that are of most importance in determining a members’ degree of happiness with the process and decisions can be identified.

Kraemer and King (1988) suggest three directions for future GDSS research.
1. A more rigorous and detailed examination of the experiences of groups using GDSS. Researchers should examine carefully a number of significant successes and failures.
2. Study group decision making in vivo, in routine organizational settings, both with and without the benefit of GDSS.
3. More detailed experimental examinations of GDSS to investigate its effects on decision processes.

The research framework is of use in all three research situations. Listed below are some suggestions for future work to be carried out using the framework and questionnaire in a wider context than that of the current research.

1. The framework can be used in detailed examinations of GDSS use and for in vivo studies to identify those variables that require a description. By using the framework as a basis for providing meeting descriptions, descriptions of a standard set of variables will be generated, thus enabling more efficient and effective comparisons of studies to be carried out. As Steiner (1972) says, “It is almost impossible to produce a complete description of any group process. Such a document would contain not only a detailed account of who is observed to do what and when but also a precise report of unobserved events transpiring inside individual members”. However, Steiner (1972) suggests that researchers describe what they can see and make educated
guesses about the rest. The framework provides a model for researchers to use to produce a description of a group process and the framework can be used for examining and mapping past research. Similarities and differences between studies can be examined and differences in results compared.

2. The framework can also be used in the design of future experimental research into GDSS. The framework suggests many causal linkages between variables which may influence the process and outcomes of a GDSS supported group process. Hypotheses generated from the framework may be tested under laboratory conditions with the control and manipulation of other variables within the framework.

3. The validated questionnaire can be used in many research settings for both laboratory and field based studies. For some research, it can be used in conjunction with the framework to test the hypotheses proposed in the framework. The questionnaire can also be used simultaneously with other measures not only to provide additional data but to allow comparison of results obtained by different measures. It can be used to assess group members' perceptions of the meeting and its outcomes for different GDSS used in different settings. However, it is important to stress that the questionnaire should be used in the context for which it was designed and intended. The questionnaire should not be changed in any way without undergoing further tests for reliability and validity.

It is anticipated that, over time, as research into GDSS progresses, new variables will be identified as being absent from the framework, variables of particular significance to the group process will be recognized and variables of little or no consequence to the group process will be removed. The need for longitudinal studies in GDSS research has been stressed by researchers, for example, Kraemer and King (1988) and Zigurs (1993). Such studies would enhance interpretation of results as some variables in the framework may be expected to change little over time which would allow some degree of control for researchers over these variables. It is also considered that unless researchers are studying the minutiae of GDSS use, they should use real groups, for as Morgan (1993) says, “it is only real problems that focus the mind”. Student groups
may represent some continuing commitment to each other and their group work if it forms part of their coursework but student groups cannot represent the complex interrelationships that are found within organizational groups, whose actions and behaviours are influenced by the large number of input variables in the framework.
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References


Appendix One

Research Framework

Introduction

An overview of the research framework, its major components and an illustration of the model were presented in Chapter Six. This appendix discusses in detail the variables of the framework using the relevant literature to indicate why the variables are considered important in characterizing a group process. As stressed in Chapter Six, the group process is not only concerned with decision-making and problem solving but many kinds of activities requiring co-operative work. Terms such as decision-making, problem solving, group task and group process are used interchangeably to refer to the group’s activities. The term task is used when no distinction is made between project, meeting, task and subtask.

The research framework variables

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<th>Input variables</th>
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Outer organization environment

Group co-operative working within an organization varies according to its degree of strategic importance but, ultimately, all co-operative working has, as its goal the continued efficient existence of the organization within the wider environment. This wider environment, which exists externally to the organization, and changes within it, could be expected to influence considerably and dictate the direction of group problem-solving occurring within the organization.

To ensure an organization’s survival it is important to match the activities of an
organization to the outer environment in which it operates. No organization can be understood in isolation from the larger environment in which it exists and to which it must adapt (Scott, 1981). The outer environment plays a major role in determining the activities of the organization where the organization is essentially composed of individuals who carry out actions designed to ensure its survival (Hall, 1974). Strategic analysis entails studying the outer environment to identify changes in it which may signal a need for an adaptive response from the organization, either to ensure it’s survival or to realize its potential for growth. Changes in the outer environmental conditions will activate the need for organizational group problem-solving (Baskin and Aronoff, 1980). Furthermore, knowledge of those factors of most importance in influencing the present and future well-being of the organization will influence the choice of strategy adopted by the organization (Johnson and Scholes, 1984). These factors have the capacity either to place constraints both on the feasibility of the organization’s future objectives and on possible courses of action (Radford, 1978) or to highlight potential areas of growth for the organization.

Many types of environmental conditions have been listed as having possible effects upon organizations and their group decision-making. These include:
1. technological conditions (Duncan, 1972; Hall, 1974; Johnson and Scholes, 1984; Radford, 1978; Scott, 1981);
2. legal conditions (Hall, 1974; Johnson and Scholes, 1984; Ralston, 1985);
3. political conditions (Duncan, 1972; Hall, 1974; Ralston, 1985);
4. economic conditions (Baird and Thomas, 1985; Hall, 1974; Johnson and Scholes, 1984; Kerr, 1979; Radford, 1978; Ralston, 1985);
5. demographic conditions (Hall, 1974);
6. ecological conditions (Hall, 1974);
7. socio-cultural conditions (Duncan, 1972; Hall, 1974; Johnson and Scholes, 1984; Ralston, 1985; Scott, 1981);
8. labour market (Johnson and Scholes, 1984);
9. market environment, for example, competitors, customers, supplies, other organizations with similar or different purposes (Duncan, 1972; Johnson and Scholes, 1984);
10. climatic and geographic conditions (Hall, 1974);

Researchers have proposed possible terms for use in characterizing the outer environment. These terms are concerned with such attributes as complexity (Scott, 1981; Gordon, 1991), nature of decision processes occurring in the environment, homogeneity of environmental factors (Scott, 1981) and rate of change of the environment (Emery and Trist, 1965; Lawrence and Lorsch, 1967; Scott, 1981; Gordon, 1991).

Emery and Trist (1965) categorize the environment according to four types, namely, placid-randomized, placid-clustered, disturbed-reactive and turbulent. The four environmental types are ordered according to the degree of relationship between the elements of the environment. Placid-randomized represents little or no interaction between the elements while turbulent represents interactions that are intense and continuing. The dimensions upon which the four types vary are complexity and dynamism. Specifically from placid-randomized through to turbulent textures, the environments are characterized by increasing complexity and dynamism where complexity results from the diversity of environmental influences faced by an organization and dynamism is concerned with the rate and frequency of change (Johnson and Scholes, 1984). Organizations experience one or more of these types of environment during the course of their operations and organizations engaged in more than one activity may experience different types of environment simultaneously (Radford, 1978).

Duncan (1972) also defines the organizational environment in terms of the two dimensions complexity and dynamism. The simple-complex dimension refers to the number and diversity of environmental factors faced by an organization and their interconnectedness while the static-dynamic dimension refers to the rate of change of the environmental factors. Duncan (1972) uses these two dimensions to define four classes of organizational environment and proposes the degree of uncertainty an organization can expect to experience in each of these environments, as given below:

1. a simple-static state represents low uncertainty;
2. a static-complex state represents moderate uncertainty;
3. a simple-dynamic state represents moderately high uncertainty;
4. a dynamic-complex state represents high uncertainty.

The environmental uncertainty experienced by an organization, threatens its ability to survive and to attain its goals (Kerr, 1979).

The complexity of external environments and their rates of change are seen to be increasing (Johnson and Scholes, 1984; Radford, 1978). Various explanations have been given for these changes. Radford (1978) believes increased complexity is due mostly to the pace and pattern of modern life which has led to an increased degree of specialization within organizations while increasingly turbulent environments have arisen as a result of factors such as a deepening interdependence between various facets of society and the need for change as a means of meeting competitive challenge (Radford, 1978). Johnson and Scholes (1984) suggest increased complexity is due to increasing interconnectedness between environmental influences. Thus, the need for organizations to adapt to their external environment and consequently, the need for strategic analysis and decision-making is becoming increasingly important.

Many environmental factors that exist in the outer organizational environment have been identified as possibly influencing the organization and its consequent actions and thus should be present in any organizational group process model. However, it would be difficult to analyze the influence of each individual factor on an organization’s activities. The terms “complexity” and “dynamism” have been used in the literature by several researchers to describe the general characteristics of an organization’s outer environment. It is proposed to adopt these terms in this framework to describe generally the outer environment in which the organization exists. It is expected that the outer environment will remain relatively stable over a project life time.

**Organizational environment**

“Organizational environment” refers to the internal environment of the organization itself, within which group processes occur and, when appropriate, solutions are
The term "organizational climate" is useful for defining the internal environment of an organization. It refers to a set of organizational and perceptual variables that reflect individual-organizational interactions and which affect an individual's behaviour in an organization (Glick, 1985). The climate of an organization distinguishes it from other organizations and, in order to comprehend it, it is necessary to understand the organization as a complex system characterized by the interaction of many variables (Gilmer, 1971). There are many factors which are thought to have the potential to influence the formation of climate perceptions. These include structure of the organization (James and Jones, 1976), social structure (Duncan, 1972), organizational goals, attributes of the external environment, group processes, task characteristics, physical location, organizational size, technology (Kerr, 1979), leadership patterns, communication networks, goal directions and decision-making procedures (Gilmer, 1971). In particular, two important aspects of climate which influence the decision-making in groups, are the degree of empowerment of middle managers and the extent to which authority and responsibility are delegated (Morgan, 1993). In turn there are several factors which are potentially affected by climate perceptions, including job satisfaction and performance, leader behaviour and group processes (Kerr, 1979).

Researchers emphasize the perceptual and psychological nature of climates which make them difficult to evaluate (Gilmer, 1971; Kerr, 1979). If organizational climate is a summary perception of the organizational environment, then objective features of the environment can only influence behaviour when they are incorporated into the individual's life space. Organizational climate acts as an important intervening variable linking organizational structure, practices and procedures to individual behaviour.

Duncan (1972) reasoned that the climate of the organization should support the necessary behaviour expected from organizational personnel in order to ensure the organization's continued survival. The more complex and dynamic the environment the more likely it is that the climate is geared towards dealing with uncertainty produced by competitors and changes in technology. A group or individual within the
organization should find that behaviours which contribute to the organization’s adaptability to the outer environment will be supported by the climate. In more predictable and less competitive environments, individuals should encounter assumptions and derivative values that relate to institutionalizing the ways in which the company operates.

The terms “climate” and “culture” are often used synonymously. However, according to Glick (1985), climate refers to the variables affecting the individual’s perception of the environment and culture refers to how the interpretation of climate is translated into the organization’s culture. Culture is a shared reality or socially-constructed reality of values and beliefs that deems certain social practices to be normal, acceptable and desirable (Flood and Jackson, 1991). It can be understood as the often unspoken, but familiar ways of thinking and acting that exist in all organizations. It is a useful way of promoting a collaborative and community spirit and creates cohesion. Both official and unofficial corporate cultures exist, as well as subcultures.

Nelson (1951) developed a model of organizational climate which specifies four classes of organizational climate, namely, bureaucratic, autocratic, idiocratic and democratic. The classes are distinguishable according to the dimensions of source of authority, goals, demands on workers, supervisory motivation and leadership style

Thus, organizational climate has been shown to be a variable representing the summation of many aspects of organizational life as perceived by individuals. It influences the behaviour of individuals within the organization and pervades the group process (James and Jones, 1974; Smith, 1955).

**Group environment**

The variables in this section are concerned with the group which is a subsystem of the organizational environment and in which group processes occur.
Group members

The individuals, of which the decision-making group is composed, represent the most fundamental aspect of a group process. The characteristics of the individuals constitute a set of powerful determinants of group behaviour (Shaw, 1976), and yet they may be the least quantifiable influence upon the group process. Katz and Kahn (1966) believe the process of decision-making to be affected by the basic personality characteristics of the policy maker and the cognitive limitations of human beings which stem from both situational and personality factors. Several important characteristics of individual group members are included in the framework.

Attitude

A group participant’s attitude and motivation towards working in groups, working with members of a particular group and the group’s aims will have an important influence upon the group process (Jessup, 1993a; Pinsonneault and Kraemer, 1989; Gray et al., 1990). Attitudes influence behaviour by indicating a personal predisposition to respond in a particular way (Zaleznik and Moment, 1964; Mitchell, 1987).

Ability

The term “ability” refers to the knowledge a member has in respect of the group task and their ability to use their knowledge effectively to help the group achieve its aims (Beach and Mitchell, 1978). An important consideration is for group members to be able to communicate their knowledge effectively (Facilitator, 1992). An individual who is perceived as having specific abilities relevant to the group’s task will be more active in the group, make more contributions and will have greater influence on the group’s deliberations (Shaw, 1976).

Background

The “Background of group members” is composed of a number of characteristics including member’s gender (Jessup, 1993a), previous experience of working in groups (Pinsonneault and Kraemer, 1989; Gray et al., 1990), education (Duncan,
1972; Gray et al., 1990), intelligence (Jessup, 1993a), knowledge specific to the group task (Beach and Mitchell, 1982), age (Gray et al., 1990; Facilitator, 1992) and computer ability (Gray et al., 1990). These attributes of group members play an important part in formulating group identity. Zaleznik and Moment (1964) subdivided these attributes into primary attributes over which there is no control, such as sex and age, and secondary attributes which are not as obvious as primary attributes, such as education, ethnic and religious background, socioeconomic class and marital status.

**Emotional state**

The mental and emotional states of group members during the group process can affect group performance (Kerr, 1979; Facilitator, 1992). A member's emotional state may depend on factors such as the level of stress experienced during the journey to the meeting. Any extremes of emotional states are likely to diminish as the meeting proceeds and member's attention is drawn to the subject under discussion.

**Culture**

A person's culture and nationality can act as a strong influence upon their behaviour (Facilitator, 1992). Gray and Olfman (1989) stress the importance of considering the culture and spoken language of potential users when designing a GDSS. The degree of technology used to support a group is more appropriate for some cultures than for others. Ackermann (1993) believes that personnel within UK-based organizations are not as technologically aware as US-based organizations. She stresses the importance of cultural influences such as the openness of people, their cultural behaviour patterns and trivialities, such as colour, which can influence a group process.

An example of the effect of culture on group process is demonstrated by the following example. Decision Conferencing (DC) was used in the USSR to investigate the effects of the Chernobyl accident on the local population (French et al., 1992). A rule of DC is that no papers or prepared material are allowed on the first morning (French et al., 1992). However, many of the participants arrived at the event prepared to read speeches and so were allowed to, after which silence reigned until they began open discussions which is the usual practice of DC. Thus, this example shows how
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group members' culture can influence the group process.

**Decision-making style**

Keen and Scott Morton (1978) view the decision maker as a unique individual with personalized strategies and abilities. They suggest that a person's specialized style of decision-making will be very effective in some contexts but less so in others. The outcome of the decision process is substantially influenced by these characteristics.

A number of models of decision-making styles has been proposed. McKenny and Keen (1974) view problem-solving in terms of the processes through which individuals organize the information they perceive in the environment. McKenny and Keen (1974) classify modes of thought along two dimensions. The first mode of thought is information-gathering which relates to the processes by which individuals organize the verbal and visual stimuli they encounter. This dimension of information-gathering distinguishes receptive, data-sensitive, analytic individuals from preceptive, data-filtering, intuitive individuals. Analytics tend to be attentive to detail, while intuitives focus on patterns. The second mode of thought is information-evaluation which refers to how the individual uses the perceived information to solve problems. This dimension distinguishes systematic, structured decision-makers (analytics), from holistic, trial and error problem solvers (intuitives). Analytics determine the quality of a solution by assessing the method followed to reach it while intuitives focus on the solution of "best fit". By combining the two dimensions of preceptive/receptive and intuitive/systematic, four categories of personalized problem-solving styles emerge.

Beach and Mitchell (1978) present a rather simpler categorization of decision-maker styles. They argue that the decision maker uses one of three general types of strategy namely, aided analytic, unaided analytic and nonanalytic. The aided analytic employs a formal model, formula or aid such as a checklist to reach decisions. An unaided analytic strategy entails following a rough mental model of decision-making where the advantages and disadvantages of each alternative and the consequences of each action are considered. The nonanalytic strategy is adopted by the decision maker who chooses by habit or uses some simple rule of thumb. The strategy a person selects is contingent upon the personal characteristics of the decision-maker and the demands
of the task (Beach and Mitchell, 1978). A decision maker's perception of the group task characteristics influence their strategy selection for problem solving. Task characteristics includes its unfamiliarity, ambiguity, complexity and instability and task demands such as its irreversibility, significance, accountability and time/money constraints (Beach and Mitchell, 1978). Decision maker characteristics include the decision maker's experience of similar situations (Bouwman, 1984), their knowledge, ability and motivation.

Katz and Kahn (1966) believe there are four important personality dimensions which influence an individual's decision making style:

1. a person's orientation to power versus their ideological orientation, that is, the degree to which they stick rigidly to organizational objectives and rules;
2. their emotionality versus their objectivity;
3. their creativity versus their conventional common sense;
4. their action orientation versus their contemplative qualities, that is, their ability to transform thought into actions.

Different people are known to use different strategies for the same problem while different strategies are used by the same person when confronted with different problems (Mitchell, 1987) and different phases of the problem-solving process (Hunt et al., 1989).

How the decision making style of an individual is perpetuated once they become a member of a group is not addressed in the literature nor how individual problem-solving strategies are influenced by the use of a GDSS. However, an individual's decision-making style is an important determinant of decision-making success on an individual basis and a predisposition to a certain style is likely to be sustained to a degree once the individual becomes a member of a decision-making group.

**Group situation**

Group situation refers to those variables which characterize a group at the start of the interaction process.
Reasons for group membership

Participation within the group can be voluntary or forced (Mitchell, 1982). Voluntary participation occurs as a result of social needs such as the need for social interaction, self esteem or for rewards while involuntary participation occurs as a result of a need to achieve goals by pooling resources. Within an organization, involuntary participation may be part of regular work activity or may occur at a superior’s request. Compatibility of the group members is an important factor to be assessed when membership of the group is not solely voluntary (Jessup, 1993).

Stage in group development

Groups are known to develop through a process of several stages as they gain a history. A number of models has described in greater detail the process of group development (for example, see Luft, 1984). One example is that of Tuckman’s (1965) model of group development which consists of four stages.

1. Testing and dependence. Group members attempt to understand acceptable and unacceptable behaviours and the norms of the group. Individuals determine their place in the group, identifying high-status and powerful members and who they like.

2. Intragroup conflict. Members try to establish and solidify their position and endeavour to acquire influence over decisions made.

3. Development of group cohesion. Members come to accept fellow members and group norms are developed.

4. Functional performing. The efforts of group members become oriented toward task and goal accomplishment.

Group development establishes the pattern of interaction for future group meetings which in turn influences the group interaction process and task performance (Mitchell, 1982). The fact that a group has both a history and a future, influences how group members perceive and react to each other (Ackermann, 1993). A crude measure of group development could be obtained from the number of times a particular group of participants has worked together.
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Existing social networks

Social networks between group members reflect the extent to which participants have interacted with each other prior to the group process (Pinsonneault and Kraemer, 1989). Existing social networks can assert great social influence on the group and the resulting group process (Jessup, 1993a).

Accountability

Accountability is concerned with the degree to which each individual is personally accountable for the decision reached and the extent to which the members present have the authority to make a final decision (Facilitator, 1992).

Commonality of goals

This variable refers to the extent to which the aims of the individuals in the group are the same or different. Jelassi and Foroughi (1989) define commonality of goals as the degree of cooperativeness among negotiators which significantly affects both the required communication needs and the manner in which an agreement is reached. They identify three modes or methods by which a decision is reached according to the degree of cooperativeness existing among group members. Firstly, the "pooled mode" represents much cooperation within the group, with the group acting almost as a single decision-maker. Secondly, in the "cooperative mode", individuals make decisions which are presented to the group. This mode involves coming to terms with, understanding and accepting each other's solutions and engenders negotiation. Thirdly, in the "non-cooperative mode", members have their own problem representations and preference structures. Negotiations must integrate these often conflicting and incompatible problem representations into a common solution. March and Simon (1958) suggest that commonality of goals within the group can be controlled by varying the requirements for "group admission".

Friend (1990; 1993) identifies four simple modes of group accountability ranging from a group where members are identical in terms of their accountability to a multi-organizational group where the facilitator takes on more of a rôle of arbitrator or conciliator to resolve conflicts. Many GDSS assume that groups are working together
to achieve the same goal, but this is not always the case (Friend, 1990). Problems arise of reconciling accountability and commitment when group members represent different organizational interests (Friend, 1993). Dealing with different modes of group accountability requires flexibility and adaptation from both the facilitator and the GDSS.

Group members can hold personal motives or hidden agendas which can affect the group process (Facilitator, 1992). Hidden agendas, the difference between declared and unspoken agendas (Zaleznik and Moment, 1964), usually become apparent in the early stages of the group process. If an individual holds some personal motives they will try to influence and manipulate the process to further their own aims (Facilitator, 1992). Morgan (1993) distinguishes between several forms of group oriented motives. Is the group there to decide for, or with, the Sponsor calling the meeting, to inform the Sponsor so that he or she can make a decision or simply to endorse a decision already made?

Hidden agendas amount to conflicting goals and are a source of conflict which can impede group work (Zaleznik and Moment, 1964). Conflict has been described as the process which begins when one group member or party perceives that another has frustrated or is about to frustrate some concern of theirs (Kerr, 1979). Kerr (1979) describes five conflict handling modes. “Competing” occurs when an attempt is made to attain one’s own concern at the other party’s expense; “accommodating” satisfies the other party’s concerns at the neglect of one’s own; “avoiding” neglects both one’s own and the other party’s concerns by sidestepping or postponing the raising of conflict issues; “collaborating” is an attempt to fully satisfy the concerns of both parties and “compromising” seeks partial satisfaction for both parties through a middle ground position which requires mutual sacrifice.

Commonality and openness of group member goals constitute complex concepts which have significant influence on the group process.
Breadth of participants

This is concerned with the degree to which participants are from different organizational divisions and sites or are of differing seniority within the company (Facilitator, 1992). Martz et al. (1992) attempt to measure the breadth of group members using three scales. Firstly, homogeneity measures the ability of a group to be easily divided into subgroups whose members support the same basic positions and attitudes toward the problem domain. Secondly, managerial height captures the number of managerial levels represented by the members of the group, that is, it measures the “tallness” of a group. Thirdly, group width measures the breadth of groups by evaluating the number of different business functions or departments represented by the group members. From personal experience, Morgan (1993) found that groups consisting of three or fewer managerial levels are more productive than when group members are drawn from four or more levels.

Group density

Density of the group is a composite factor of the variables size of the group, size of the room and the consequent interpersonal distance between group members (Pinsonneault and Kraemer, 1992). Group size has major consequences for group work (Martz et al., 1992), influencing the amount of interaction within the group, member satisfaction and productivity (Mitchell, 1982). Increased group size can reduce member motivation as members feel that their potential contribution to group success is diminished (Kerr, 1979). Technology can overcome some of the problems associated with a large group when members may be intimidated about giving their opinions, for example Teamworker (Gear, 1993b) incorporates the use of handsets which allows all members to anonymously input their opinions.

Of particular importance is not the actual size of the group, but whether the number of participants present is appropriate to the task (Facilitator, 1992). A smaller group may be more appropriate when focussing on details (Facilitator, 1992). Ackermann (1993) advises that if different managerial levels are represented in the meeting, it may be wiser to have a larger group than if members were all from the same managerial level. Nunamaker et al. (1989) state that group size should be treated as a
relative rather than an absolute characteristic. The extent of group member domain knowledge, that is, the knowledge that an individual member has concerning the current task could result in having a logical group size significantly different from its physical size. Increasing group size can increase productivity up to a certain point until there is no longer any addition of further useful skills and resources and at this stage, increasing group size leads to process losses (Steiner, 1972).

Personal space refers to the area around an individual that is felt to be private and others should not enter (Mitchell, 1987). Its boundaries vary according to the situation and intrusion into it causes discomfort and anxiety. Territoriality is concerned with the phenomenon that individuals and groups often feel they own or have rights to certain objects or space. It is the area used or occupied by them and refers to objects such as chairs and desks. If a person cannot maintain their territorial integrity then conflict can occur. The implication of these feelings for territoriality and personal space is that they can be constrained by the interpersonal distance achieved within a group which is determined by the spatial arrangements of the physical setting for a group process. Feelings for territoriality and personal space can strongly influence the quality of the group's interaction. Thus, the physical arrangement of the group can constrain or enable interaction as well as physically channelling the communication process (Zaleznik and Moment, 1964).

**Group structure**

The term “group structure” refers to the patterned relationships that develop among members of the group as a result of interaction with the group (McGrath, 1964). Group structure expresses how members relate to one another (Luft, 1984) and is patterned in terms of status, power and affection. Status, value, and power hierarchies within a group may be established formally or informally. Many of these variables are highly interrelated (Ackermann, 1993) in particular, status relationships, breadth of participants and density of group (Morgan, 1993).

Group structure serves a purpose as it enables the group to function well, to achieve its purpose and to derive satisfaction from its efforts. It grows out of a need for effective group work and gives some degree of order and predictability to the
functioning of the parts of the group (Luft, 1984). The group's ability to pattern and integrate the potential skills of the individual members influences the group's performance (Collins and Guetzkow, 1964).

McGrath (1964) states that there are many possible bases from which patterns or group structures can develop. Group structure could develop in terms of division of labour on tasks or as communication, power or interpersonal relations structures.

Group structures are difficult to define but manifest themselves in the more observable aspects of group interaction (Zaleznik and Moment, 1964). Group structure develops and changes over time as the group matures and gains a history. It is characterized by several features as discussed below.

**Group norms**

Group norms are concerned with the behaviour which group members can anticipate from the other members, according to the prescriptions associated with a particular position (Shaw, 1976). A norm defines a range of acceptable and unacceptable attitudes and behaviours for members of a social unit (Brown, 1988). They are set standards of members' behaviour (Kerr, 1979). Such standards reduce the uncertainty concerning the possible behaviour of other group members and results in increased interaction (Baskin and Aronoff, 1980).

Janis (1972) described a phenomenon he termed "groupthink", where group norms exert a strong influence on group members. In such situations, the pressure to conform is high and when rewards or punishments clearly accompany the transmission of certain types of information, the group may ignore or distort certain information in order to reach decisions they may not have otherwise reached.

Group norms can act as a major source of pressure towards uniformity in order to attain group goals (Baskin and Aronoff, 1980). However, the strength of pressure towards uniformity depends on the desirability of the goals. The more a member feels dependent upon the group to achieve their own goals, the greater will be the tendency towards uniformity.
Power relationships

Power relationships which exist between group members also have a strong influence upon the behaviour of individuals within the group. Power relationships have been described as the control or influence one person has over another (Shaw, 1976). It is concerned with the relationships between two or more actors in which the behaviour of one is affected by the other (Hall, 1974).

Hall (1974) discusses a five class typology of power based on the nature of the relationship between the power holder and the power recipient. Firstly, "reward power" exists where the basis of power is the ability to reward. It is limited to those situations where the reward is meaningful for the power recipient. Secondly, "coercive power" is based on the recipient's perceptions of the power holder's ability to distribute punishments. Thirdly, "legitimate power" exists where the recipient acknowledges that the power holder has the right to influence him or her and they have an obligation to follow the directions of the influence. Fourthly, "referent power" is present when a power recipient identifies with a power holder and tries to behave like him or her. In this case the power holder may be unaware that they are a power holder. Finally, "expert power" is based on the special knowledge attributed to the power holder by the recipient. The power recipient believes the knowledge the power holder has is relevant and that they themselves do not have that sort of knowledge available. All these relationships could exist within the decision-making group with the potential to affect the decision outcomes.

The power status hierarchy in a group influences the flow and content of communication within a face-to-face group with more communication being directed to the person of greater or greatest power status who will also initiate more communication than members of lower power status (Collins and Guetzkow, 1964). Thus, communication patterns can indicate the structural patterns of power within the group.
Status relationships

Differences in the status between group members is an important determinant of group interaction. Status refers to an individual’s rank, worth or prestige within some group, organizational or social setting (Mitchell, 1987). It is determined by the group itself. If a person has attributes or possessions that are valued by the group, he or she will have high status. Those people without these attributes or possessions have low status.

There are three important facets of status. Firstly, status is determined by criteria set by the group that are generally agreed as being of value. Secondly, status is an aggregate or overall estimate of worth and is typically based on more than one attribute. Thirdly, status serves as a device for ranking people, that is, for putting them in some sort of order in relation to one another. It provides a way of vertically differentiating between group members.

The status hierarchy within a group can also be observed from group communication and interaction patterns. High status implies a tendency to initiate ideas and activities (Brown, 1988). Members with high status are more likely to start a conversation and frequently make policy statements or generalizations without providing data or information to support their position. High status members talk more, are more likely to be the group’s representative and have the greatest number of connections within the group. Furthermore, they have greater influence and power. High status also implies consensual prestige, that is, a positive evaluation or ranking by others in the group, an evaluation of which can be elicited by questionnaire or interview (Brown, 1988). It is sometimes difficult to determine exactly what causes these differences in status (Mitchell, 1987).

Group cohesion

Group cohesion results from forces which act on members to stay in the group. Members of cohesive groups are motivated to work towards the group objectives, they are attracted to each other, the group is well-organized and achieves its goals (Luft, 1984). A highly cohesive group is one in which all members have a very
positive attitude toward the group and are strongly attracted to it (Mitchell, 1987). Cohesion refers to the overall pattern of attraction of all group members and not to the attraction of individual members. The group as a whole may be highly cohesive and yet there may still be individual members who are not strongly attracted to it. Generally, cohesion is weaker in larger groups (Luft, 1984).

Ralston (1985) warns that too much cohesion leads to "group-think", as previously described by Janis (1972), which may result in irrational behaviour, while too little cohesion makes it difficult to maintain membership of the group and hence, accomplishment of group goals.

Group cohesion is influenced by several factors.
1. **The type of task being performed.** Tasks that foster a high degree of interaction among group members are more likely to generate group cohesion.
2. **The way the task is physically arranged.** Members working in close proximity interact more frequently which leads to greater cohesion.
3. **A group history of success** at tasks tends to result in greater cohesion.
4. **Common goals** lead to cohesion as they provide a focus for the group members around which attraction to the group can develop.
5. **An ability to influence the group decision process** leads to greater cohesion.
6. **Personal characteristics** such as similarities in race, background, education, attitudes and values lead to greater group cohesion.

In turn there are several consequences of group cohesiveness.
1. Highly cohesive groups spend more time communicating, communication is freer and less restrained and the quality and quantity of group interaction is increased.
2. Highly cohesive groups exert a strong influence on the behaviour of individual group members who are more likely to comply with group norms.
3. Highly cohesive groups are more likely to experience a high level of job satisfaction as one measure of satisfaction is an assessment of employees' relationships with their coworkers.
4. Highly cohesive groups are more successful as cohesion leads to a motivation to perform well.
Communication and interaction are important aspects of group cohesion. Increased interaction leads to increased attractiveness which results in greater cohesion (Zaleznik and Moment, 1964). Thus, it can be seen that group cohesion influences group process and performance but is itself influenced by group functioning.

**Group support**

The variables listed under the term "group support" are concerned with features of the GDSS used by the group.

**Type of support**

This variable refers to the type of group support used, for example, whether it supports group communication or group problem solving. Examples of GDSS include SODA (Eden et al, 1986), Strategic Choice (Friend and Hickling, 1987), SSM (Checkland, 1981) and Teamworker (Gear and Read, 1993). This variable also includes a description of how the designed methodology, the tools, the technological support and a combination of these are used to support the group in its cooperative work. It is important to include a description of the protocol for feeding back various results and assessments of the group process to group members (Gear, 1993b).

**Agenda structure**

This variable refers to the degree of structure associated with the methodology used. To what extent must the group adhere to a problem-solving process agenda imposed by the method? To what extent are the methods comprising the decision-making process hierarchically structured? It is also concerned with how the GDSS structures the interpersonal interactions within the group and the degree of formality of the structure, for example, some GDSS, particularly IT-based GDSS, impose restrictions on when group members are allowed to input their ideas.

The need for flexibility of the GDSS methodology has been discussed. Many of the methods developed in the UK allow a high degree of flexibility in the process. This is important, for as Cropper (1990) says, different situations require different responses, the use of different tools and combination of tools and different ways of using them.
He continues that consultants using the same GDSS methodology, such as SODA, may use the methods available in quite different ways; consultants may call upon a varied repertoire of methods and personal philosophy to enhance a decision process.

Friend (1990) identifies the need for an "organizing framework" for a GDSS, as opposed to a "tight method", which allows the facilitator to respond flexibly and sensitively to the nature of the group. While flexibility is important, Ackermann (1993) feels there is a need for some recognition of an agenda as this gives the group a sense of progress and an idea of group goals. However, Ackermann (1993) stresses that agendas are to be broken and not to be strictly adhered to.

Churchill (1990) believes that differences in the nature of organizations influences how a facilitator approaches the decision event and the skills needed. The facilitator has great influence over the group process; they can control the time spent on a particular subject and can take corrective measures when group dynamics are impeding the group process.

**Degree of anonymity**

The ability to contribute ideas anonymously is thought to have a major impact on the group process and outcomes and has been researched extensively (see section 4.1 and 4.2). This variable refers to the degree to which the group support allows anonymity of inputs.

**GDSS personnel**

Two personnel rôles may form part of the GDSS. Firstly, the role of facilitator requires the application of group facilitation skills (Bostrom and Clawson, 1992). Important characteristics of the facilitator which may influence the group process include their degree of expertise and experience, their rapport with the group and the amount of training they have undergone (Facilitator, 1992). The facilitator brings his or her own personal preferences and philosophies for using the methods and technology to enhance the decision process (Cropper, 1990). Thus, two facilitators using the same method may practice quite different styles (Bryant, 1993). The
facilitator has to make decisions about when to use particular techniques from a methodology, when to suppress discussion in order to move the debate forward in a new direction, and when to pause, reflect and break off for refreshments (Mayon-White, 1990). Phillips and Phillips (1993) also discuss the role of the facilitator in work groups and the skills they require for effective working.

The second GDSS personnel rôle is that of scribe (Facilitator, 1992). The scribe can enhance the group process by helping the facilitator with the more physical aspects of facilitating such as typing the group’s responses into a personal computer as the process progresses so that members can take a printout of the group’s efforts with them when they leave the meeting. The scribe may also help with manual tasks such as sticking flip chart paper on the walls. Bostrom and Clawson (1992) use the term “technical facilitator” for the role of scribe in IT-based GDSS. The technical facilitator is technically competent to run the technology and must ensure that technical difficulties do not interfere with the process of the meeting.

Physical setting

An “effective physical setting for the group is just as crucial to the success of the group decision support” as the need to manage the process and the content of the group process (Eden, 1990). The importance of the physical setting in which the group process occurs has been discussed by several researchers.

Friend and Hickling (1987) discussed the management of the physical aspects of the technology, that is, the effective use of walls, paper and pens and Hickling (1990) presented a chapter on the design requirements for the ideal decision centre. Huxham (1990) examined what are termed “trivial” matters, such as the clothing and general appearance of the facilitator.

Various attributes of the decision room have been considered including the facilities available for use, such as a white boards, flip charts, overhead projectors, wall-hanging space and availability of main room and syndicate rooms (Facilitator, 1992). Other attributes include the warmth of the room (Kerr, 1979; James and Jones, 1976), humidity (Kerr, 1979), lighting conditions, including the amount of natural daylight
(Kerr, 1979; James and Jones, 1976), the seating arrangement (Facilitator, 1992) and table shape (Gray \textit{et al.}, 1990). Gray and Olfman (1989) stress the importance of adequate desk space for group members while Mantei (1989) mentions the importance of appropriately positioning the monitors for those processes where IT is used to support the group. Support services are equally important, namely the availability of a telephone, refreshments and toilets (Friend and Hickling, 1987).

The physical arrangement of the room can enable or constrain interaction and can physically channel communication (Zaleznik and Moment, 1964). Seating arrangements are known to influence communication patterns within groups because it has been observed that people communicate more with those people with whom they are in close physical proximity (Collins and Guetzkow, 1964).

These variables which describe the attributes of the physical setting of the group process could be considered as “hygiene factors”, the term used by Herzberg as described by Vecchio (1991). Hygiene factors are concerned with the context in which a job is performed and although they are unable to motivate an individual to higher levels of productivity, their absence could lead to dissatisfaction.

\textbf{Task characteristics}

These variables describe the characteristics of the task faced by the group, which are known to influence decision-making behaviour (Sainfort \textit{et al.}, 1990; Biggs \textit{et al.}, 1985).

Ackermann (1993) proposes a continuum of task types which are conducive to group support with one extreme representing on-going, strategic development problems, while the other end represents one-off, “messy” problems. Ackermann (1983) stresses that task type affects several aspects of group problem including the need for team building within groups working with on-going strategic problems.
Nature

The nature of the group's task determines the activities of the group (Katz and Kahn, 1966; Dennis et al., 1988; Pinsonneault and Kraemer, 1989). Task types have been defined by various researchers, for example, Pinsonneault and Kraemer (1989), Hickson et al. (1986) and Martz et al. (1992), but the most comprehensive definition has been given by McGrath (1984).

McGrath's (1984) circumplex model of group task types proposes that there are four processes indicating what the group should do, namely, generate (alternatives), choose (alternatives), negotiate and execute. Each of these four processes are divided into two subtypes of tasks. Quadrant 1, “generate”, consists of planning tasks with the generation of action-oriented plans and creativity tasks involving the generation of ideas. Quadrant 2, “choose”, consists of intellective tasks where problems have a correct answer and decision-making tasks where the agreed or preferred answer is the correct one. In quadrant 3, “negotiate”, cognitive conflict tasks involve the resolving of conflicts of viewpoints while mixed-motive tasks involves resolving conflicts of interest entailing negotiation and bargaining. Quadrant 4, “execute” tasks, consist of contests and battles where there is competition for victory and performances where tasks are performed against objectives in an endeavour to excel. Planning, creativity, intellective and performance tasks represent cooperative group activities while decision-making, cognitive conflict, mixed-motive and contests and battles represent group conflictive tasks. Furthermore, planning, mixed-motive, contests and battles and performance tasks represent behavioural activities while creativity, intellective, decision-making and cognitive conflict tasks represent conceptual tasks. The dynamic nature of group problem solving means that a task may exhibit more than one task type (Nunamaker et al., 1989).

Complexity

Complexity of the task has been defined by several researchers. It can arise from both complexity of the problem and complexity of the response (Gray et al., 1990). Hickson et al. (1986) view complexity as originating from four main sources.

1. Rarity of the matter for decision.
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2. The consequentiality of the task, that is, the consequences may be radical, serious, widespread or longterm.
3. The precursiveness of the decision, that is, the consequences of this decision for other decisions.
4. Its involvement, that is, the complexity arising from an increasing number of interests involved in the decision leads to an even greater variety of information.

Churchill (1990) sees complexity as a multi-faceted variable which is concerned with a lack of definition or agreement over quantitative parameters, conflicting multiple objectives, conflicting participants and an incomplete or overwhelming amount of information. These engender a whole host of complex variables such as defining a portfolio of options to satisfy competing objectives.

Dennis et al. (1988) assess complexity as the sum of the number of issues and the number of alternatives that must be considered, the time required to identify and assess the issues and alternatives, and the number of interrelated actions required to complete a task. Obviously, the greater the number of actions required to complete an activity, the greater the complexity (Martz et al., 1992).

Uncertainty

Uncertainty arises in those situations where the probability of the outcome of events is unknown (Luce and Raiffa, 1987). Uncertainty of a problem is related to the nature of the environment in which the organization operates. As the environment becomes increasingly complex, dynamic and turbulent, there is a resulting increase in the amount of uncertainty experienced by organizations (Johnson and Scholes, 1984) and by decision makers within the organization (Radford, 1978; Duncan, 1972). In a dynamic environment the group may be faced with many possible outcomes to a problem whereas in an unchanging static environment there is only a finite number of outcomes to events (Duncan, 1972). Uncertainty consists of three components.

1. The lack of clarity of information (Lawrence and Lorsch, 1967), particularly regarding the environmental factors associated with a given decision-making situation (Duncan, 1972).
2. The long time span of definitive feedback (Lawrence and Lorsch, 1967), including
the lack of knowledge concerning how much an organization would lose if the decision were incorrect (Duncan, 1972) and the lack of knowledge and predictability concerning the consequences of the decision (Pinsonneault and Kraemer, 1989).

3. The general uncertainty of causal relationships (Lawrence and Lorsch, 1967) and particularly, the inability to assign definitive probabilities as to how environmental factors would affect the success or failure of the decision group in performing its function (Duncan, 1972). The organization is unable to predict the likelihood of some future state or event which would favour one alternative rather than another.

Radford (1978) believes that an organization may never have complete information about the environment and therefore, will always operate in an atmosphere of some uncertainty.

Friend (1993) discusses how it may be necessary to bring out individual uncertainties in order to develop a view of “group uncertainty”. Strategic Choice has been developed from the understanding that there are three broad classes of uncertainty concerned with problem-solving, namely, uncertainty over the operating environment of the decision maker (UE), uncertainty over the policy values of the decision makers (UV) and uncertainty in related fields that are outside the present decision area (UR) (Friend, 1983). UE-type uncertainties are “managed” through investigations such as surveys or forecasting experiences in an endeavour to gain information regarding the uncertainty, while UV uncertainties are dealt with by “sounding out” the opinion of accountable decision makers. UR uncertainties are “managed” by extending the decision agenda, which may involve bringing in other decision makers. Where there is uncertainty there is bound to be some risk associated with the task.

**Duration**

This variable can be either an estimate of the length of time required to complete an activity or a time limit for task completion. The duration of a problem-solving process can vary enormously. For strategic decisions, the consultant may be working with some groups over a very prolonged period of time, that is, over a number of
months and possibly years (Ackermann, 1993).

Structure

The degree of structure of the problem refers to the extent that one can define the conditions that allow the problem to be recognized (Keen and Scott Morton, 1978). The degree to which a problem is structured is of great significance in deciding how to tackle the problem (Simon, 1977; Keen and Scott-Morton, 1978). Simon (1977) subdivides the process of decision-making into three phases, namely Intelligence, Design and Choice. Using Simon's (1977) model of the decision-making process, Keen and Scott Morton (1978) define a fully structured problem as one in which all three phases are structured. Such decisions often occur frequently in exactly or almost the same form (Radford, 1978). They are familiar problems and routine procedures exist for dealing with them such as the application of a series of steps or by the use of decision rules (Beach and Mitchell, 1978). An unstructured problem is one in which it is impossible to define the conditions that would allow the problem to be recognized (Keen and Scott Morton, 1978). In the intelligence phase, one is unable to define the problem while in the design phase one is unable to specify how to create methodologies to solve the problem. In the choice phase, no criteria exist for choosing a best solution from among those created. If all three phases of the problem solving process are unstructured in this way, then the entire problem is labelled unstructured. If some of the stages are unable to be defined precisely but the remainder can be, it is termed a semi-structured problem.

Radford (1978) terms a complex problem as “non-specifiable” which occurs when a new and unique problem arises for which no previous experience exists or alternatively, insufficient information may be available to allow the decision makers to come to a complete understanding of the problem (Radford, 1978).

Distinctions between structured and unstructured problems are of relevance to a group process as the degree of problem structure dictates, to some extent, the group's activities (McCosh and Scott Morton, 1978).
Urgency

This is concerned with how quickly a solution is required to the problem. It can influence the process by introducing time limits to the group's activities.

It may be that some parts of the problem-situation may be more urgent than others in a strategic workshop (Friend, 1993). It is important to consider how far it is the aim of the group to arrive at a “total solution”. For example, at any particular meeting it may be necessary to pursue those aims which are most urgent while making only a little progress towards less urgent group aims. In such cases it would be acceptable for the group to meet at a later date to have “another go at it”. Morgan (1993) feels that urgency of the problem is of upmost importance in the decision process as “it is only real problems that focus the mind and get the adrenaline going”.

Importance

The importance of the task and the resulting outcomes will influence group members' perceived responsibility for reaching good decisions and consequently, affects their actions in the group process. The importance of a problem is influenced by possible consequences of implementing the solution, including its irreversibility and significance (Beach and Mitchell, 1978). The greater the degree of irrevocability of the decision, the more difficult it is for group members to commit themselves to the decision and greater will be the decision-making time (Janis and Mann, 1977).

Decision-making phase

Many models of the group decision-making process have been described by researchers in organizational behaviour, for example, Kerr (1979) and Beach and Mitchell (1978). Simon (1977), whose model is more widely known, suggests that the process of decision-making consists of three phases, Intelligence, Design and Choice (as described previously). The Intelligence phase involves the perception and formulation of the problem, construction of a model of the problem and the gathering of information relevant to the problem. The Design phase involves the identification and specification of available courses of action. Choice entails determining criteria for choice between alternatives outcomes, analyzing their relative values as solutions...
to the decision problems and the estimation of the outcomes from the available
courses of action. An available course of action is then selected that is designed to
convert the present, less-desirable situation into a future situation judged to be more
desirable (Simon, 1977; Radford, 1978). The process does not necessarily occur in
this strict sequence. Simon (1977) stresses the different characteristics and
requirements of each phase of decision-making and the consequent diversity in
demands made of group members in each phase.

Sainfort et al. (1990), from their review of the literature, produce a succinct model of
the problem-solving process which comprises four major phases.
1. Problem structuring which entails recognition, exploration and definition of the
problem.
2. Generation of alternatives requiring exploration and searches.
3. Evaluation of alternatives and choice of a solution.
4. Solution implementation.

This framework does not focus on the use of GDSS to support group problem-solving
only but also to support other co-operative group work, such as helping the group to
gain an understanding of a situation. It is considered that the decision-making process
can be used to define the stages of a variety of group work. For example, using
Simon’s (1977) decision making model in a problem-understanding situation, the
Intelligence phase would involve identifying a situation which needs clarification and
gathering of relevant information. The Design phase would entail activities which
identify possible explanations for a situation, particularly from different stakeholders’
points of view, while Choice phase would involve choosing a consensus view of the
situation.

Pre work

For many facilitated meetings pre-work is a key aspect of the methodology and is
carried out by the facilitator and group members prior to the meeting. Bostrom and
Clawson (1992) specifically view a meeting as a three phase cycle involving pre-
meeting, meeting and post-meeting activities.
Dallavalle et al. (1992) recognize the importance of pre-meeting preparation. For GroupWare (Dallavalle et al., 1992), pre-work includes defining the purpose and objectives of the meeting and designing the meeting by specifying the tools and techniques of GroupWare to be used to meet the desired objectives. It is also helpful, during the pre-meeting consultation with the meeting convenor, to manage the perceptions and expectations of the meeting convenor and group members regarding the support system. Pre-work by the facilitator with participants ensures they understand the aims of the meeting and builds rapport (Facilitator, 1992).

Morgan (1993) has found that meetings move faster, sustain member's interest and provide more time for substantive discussion if the group has done some structured preparation but warns that an excessive amount can be detrimental to the process.

### Group process variables

The group process variables refer to the characteristics of the group's interaction and attempt to capture the dynamics of the interaction (Pinsonneault and Kraemer, 1989). The group process includes those intra and interpersonal actions by which people transform resources into products (Steiner, 1972). It consists of a series of behaviours each of which is determined to some degree by those that have gone before and influencing those that will come later. "Group based decisions emerge as an outcome of a social process" (Gear and Read, 1993). They express the view that it is the design and support of the social process that is the key to successful implementation of a GDSS for a given group and that an "appropriately organized group communication process is a necessary condition for achieving a good decision".

### Communication characteristics of process

The following group of variables specifically refer to characteristics of the communication which occurs between group members during the group process. Janis and Mann (1977) in their conflict theory model of decision making declare that communication variables are given prominence because decision-making is contingent on the communication of warnings, reassurances and other information
presented to decision-makers by various means of communication. The transformation of energy, that is, the accomplishment of work, is dependent upon communication between people (Katz and Kahn, 1966).

**Exchange of information**

DeSanctis and Gallupe (1987) stress that a fundamental part of group decision making is the exchange of information among members. A thorough exchange of information and ideas can result in a more complete and accurate information search and weighing of alternatives which in turn can lead to changes in the aspirations and judgements of individual members as a result of exposure to fresh information and new viewpoints that emerge in the course of a debate. The exchange of information and transmission of meaning is the very essence of a social system (Katz and Kahn, 1966).

Group problem-solving is based on the assumption that each individual in a group has some information that others need and that achieving group objectives will be facilitated by members pooling their information (Zaleznik and Moment, 1964). However, as Zaleznik and Moment (1964) assert, a pure exchange of information can be done in a more appropriate setting than a group meeting as such activities require little psychological interdependence or group identity. In some groups, members may withhold information for tactical reasons.

**Task communication**

Task communication pertains to the amount of communication that occurs between group members which is associated with the aims of the group (Siegel et al., 1986). The group’s energy is directed toward, and focussed on task problems, on assembling relevant information and on making decisions (Luft, 1984). Task communication tends to be rational, logical and linear and relies on group or organizational structure and rules to help maintain focus. Non-task communication may often be used at the start of a meeting to “break the ice” and at the end of a meeting for social reasons (Hargie et al, 1981).
Non-verbal communication

Non-verbal communication is an important communication channel in a group process (Zigurs et al., 1988). Non-verbal communication is any communicative behaviour that is not verbal (Baskin and Aronoff, 1980), for example, body posture, gesture, facial expressions and vocal expressions, and eye contact. Many of the rules that set the boundaries of interpersonal relationships in organizations are implied, rather than stated, through non-vocal behaviour (Baskin and Aronoff, 1980).

Non-verbal communication consists of both static and dynamic features (Mitchell, 1987). Static features change little during the period of an interaction, for example, the standing distance between the receiver and the sender and their physical orientation, such as face to face or side to side. Dynamic features change continuously and are part of the flow of the interaction. They include facial expressions and gestures, some of which have universal meaning, while others are idiosyncratic. Mitchell (1987) argues that information conveyed in nonverbal cues can be of two types. Firstly, process information is used to help structure the interaction between the sender and the receiver, for example, a person takes a deep breath or extends an arm when they want to say something and somebody else is talking. Secondly, content information consists of physical cues which can enhance or alter the meaning of a message. It provides information about the attitude of the sender. It is also a good indicator of the communicator's emotional state.

Co-operation

The degree of cooperation that exists within the group is dependent on several factors, for example, the degree to which group members are working towards the same goal and whether group members are of equal status which can cause conflict as members try to gain superiority (Ackermann, 1993). Conflict may occur if cooperation is absent (Luft, 1984).

Negotiation

Negotiation occurs when there is a need to resolve either a conflict of viewpoint or a conflict of interest (McGrath, 1984). It occurs through information exchange (Eden,
According to McGrath's (1984) circumplex of group task types, negotiation activities belong to a set of tasks called mixed motive tasks. In other words, participants are motivated both to cooperate and compete with one another. Competition results from a difference in the outcomes desired by each party but cooperation is required, due to the interdependence of outcomes. Neither party can achieve its goals unilaterally. It is the existence of competing goals that distinguishes negotiation from cooperative group problem solving tasks (Anson and Jelassi, 1990). McGrath (1984) also distinguishes between bargaining and negotiating. Bargaining occurs when the parties are trying to resolve their disagreement on a single dimension, often monetary, while negotiating involves trying to resolve differences on multiple issues.

Clarification efforts

Clarification efforts are made by group members in trying to understand better the alternatives, the problem or the situation (Pinsonneault and Kraemer, 1989). Eden (1990) asserts that cognitive shifts, that is, people changing their minds, depend on the extent to which new ideas can be understood. Therefore, clarification efforts to understand better the ideas and positions of other group members, are essential.

Structural characteristics of process

The structural characteristics of the group process aim to describe the structure of the process and are based heavily on the Competing Values Approach (CVA). The CVA was developed by Quinn and Rohrbaugh (1983) as a means of organizational analysis. From their work on effectiveness criteria used to evaluate the performance of organizations, they identified three dimensions which could be used as a basis for explaining the similarity and differences between 17 major criteria for assessing performance effectiveness. The first dimension reflects differences in organizational focus by contrasting an internal person-oriented emphasis with an external organization-oriented emphasis. The second dimension reflects differences in organizational preferences for structure by contrasting interests in stability and control with interests in flexibility and change. The third dimension is concerned with the emphasis on organizational outcomes as opposed to an emphasis on means, by
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contrasting a concern for ends with a concern for means. The extreme values on these continuous dimensions were opposite or "competing" values. Quinn and Rohrbaugh (1983) found that when these 17 criteria for measuring effectiveness were represented graphically in three dimensional space, according to the above three dimensions, four models of organizational analysis emerged.

McCartt and Rohrbaugh (1989) developed the work of Quinn and Rohrbaugh (1983) to produce four parallel models concerned with the effectiveness of decision processes. The four models are empirical, rational, political and consensual. Two criteria are associated with each model, the first of which provides a standard for the nature of the process, that is, data-based, goal-centred, adaptable and participatory and the second of which assesses the respective ends achieved by the decision making process, that is, accountability, efficiency, legitimacy and supportability. McCartt and Rohrbaugh (1989) measured the effectiveness of group processes by constructing scales to measure each of the eight criteria. The eight criteria used to assess effectiveness of decision processes have been incorporated into the current framework in an effort to identify the nature and structure of the process and the outcomes achieved from the process. In this section those concerned specifically with the process are defined.

Adaptable
This is the degree to which the decision process is flexible and able to adapt to stimuli from outside the decision-making group (McCarrt and Rohrbaugh, 1989; Reagan and Rohrbaugh, 1990).

Data-based
A data-based process focuses on information management and coordination to reach decisions (McCarrt and Rohrbaugh, 1989; Reagan and Rohrbaugh, 1990).

Participatory
This variable refers to the degree to which the group process encourages full and open participation from the group members (McCarrt and Rohrbaugh, 1989; Reagan and
Rohrbaugh, 1990). The degree of participation in decision making can range from autocratic decision making by a leader through consultation methods to full group participation in decision-making (Green and Taber, 1980).

**Goal centred**

A goal-centred process focuses on achieving the goals of the meeting and, ultimately, achieving organizational goals and objectives (McCarrt and Rohrbaugh, 1989; Reagan and Rohrbaugh, 1990).

**Facilitation interventions**

Interventions by the facilitator are essential for guiding the group through the problem-solving process, supporting them in the use of relevant GDSS tools and ensuring the group focusses on relevant discussions. The facilitator is in a central position for influencing the structure of the problem-solving process. This variable assesses the frequency of facilitator interventions. Frequent interventions by the facilitator could indicate that the facilitator is leading the group process as opposed to guiding the group through the process.

**Focussing on key issues**

This variable is concerned with the extent to which group discussions relate specifically to the aims of the group meeting (Facilitator, 1992) and, as a result, the group process is more efficient (Nunamaker et al., 1989).

**Outcome variables**

Outcomes from the group process are divided into two major classes, those concerned with the group’s task, that is, substantive outcomes and those which are concerned with the “goodness” of the process and have the ability to influence group members’ participation in subsequent group processes. These are called process performance indicators (PPIs) and are subdivided into tangible and intangible PPIs (Patching, 1993).
Substantive outcomes

These variables are concerned with characteristics of the resulting task outcomes. The first four variables are concerned with McCartt and Rohrbaugh's (1989) criteria for measuring outcomes achieved from the process as described previously.

Decision characteristics

Legitimacy of decision

This is the degree to which the process of decision-making results in legitimate decisions which are acceptable to external stakeholders (Reagan and Rohrbaugh, 1990).

Accountability of decision

This refers to the degree to which the use of information in the decision process produces accountable decisions (Reagan and Rohrbaugh, 1990).

Supportability of decision

This refers to the degree to which the decisions are supported by all participants as a result of full participation in the decision process (Reagan and Rohrbaugh, 1990).

Efficiency of decision

This is concerned with the degree to which efficiency and productivity of the decision-making outcome is stressed by focussing on organizational goals and objectives (Reagan and Rohrbaugh, 1990).

Degree to which objectives are achieved

This is the degree to which the objectives of the project, meeting, task and subtask are achieved.
Appendix One: The Research Framework

Political feasibility of outcomes

This variable refers to the degree to which the decision outcomes are effective decision in that their implementation will influence the future in the way that was intended (Eden, 1992a). Political feasibility is derived partly from a consideration of (a) procedural or means/end rationality, that is, an appropriate process was used to reach the decision and (b) substantive rationality, that is, the decisions make sense and a case can be made for supporting the decisions (Eden, 1992a). Simon (1978) refers to procedural rationality as the extent to which the decision process reflects a desire to make the best decision possible under the circumstances.

Implementation of outcomes

Cost of implementation

This refers to the cost of implementing the decisions reached (Pinsonneault and Kraemer, 1989).

Ease of implementation

This refers to the ease of implementing the decisions reached (Pinsonneault and Kraemer, 1989).

Organizational outcomes

These variables are concerned with measuring the performance of the implemented solutions reached in the group process. For many decisions taken within an organization, it can be expected that their implementation will result in some change in the organization. Decisions are taken to maintain the integrity of the organization and therefore organizational effectiveness and efficiency could be expected to reflect the results of implementing the decisions. Many measures of assessing organizational efficiency and effectiveness have been suggested as discussed below.

Scott (1981) discusses three types of indicators which can be used to assess organizational effectiveness. Firstly, outcome indicators, which are commonly used, focus on specific characteristics of materials or objects on which the organization has
performed some operation. However, such indicators reflect the current state and characteristics of the organizational environment and thus variations in input could affect output, reducing the reliability of outcome measures.

Secondly, effectiveness can be measured by considering organizational processes, that is, the quantity or quality of activities carried out by the organization. This type of indicator evaluates efforts rather than achievement. When the focus is on quality of performance rather than quantity, the indicators assess conformity to a given standard but they do not evaluate the adequacy or correctness of the standards themselves.

Thirdly, structural indicators can be used to measure effectiveness by assessing the capacity of the organization for effective performance. These measures focus on features of the organization and its members which are presumed to influence organizational effectiveness, such as administration processes and the adequacy of facilities and equipment. Structural indicators do not measure the work done but rather the capacity to do the work.

Hall (1974) discusses how several qualities are assumed to be indicators of effectiveness including productivity, morale, conformity and adaptiveness. Productivity is taken as the indicator most closely related to effectiveness. However, since organizations often pursue more than one goal, the degree of effectiveness in the attainment of one goal may be inversely related to the degree of attainment of other goals; effectiveness in one set of endeavours may lead to non-effectiveness in others. Therefore, assessing effectiveness is not an easy issue due to the presence of multiple, and often conflicting, goals in an organization (Hall, 1974).

Keen and Scott Morton (1978) emphasize the conflict that arises in an organization between effectiveness and efficiency. Efficiency is the central aim in stable environments where future operations can be reliably predicted from past operations. Efficient performance of last year’s tasks is much less relevant than responsive adjustment to environmental changes. The more unstable the environment in which the organization operates the greater the need to focus on effectiveness.
Johnson and Scholes (1984) suggest that the efficiency of an organization can be assessed by measuring profitability, labour productivity, yield, capacity fill, working capital utilisation and production systems and by assessing the organization’s use of people, capital, marketing and distribution resources, research knowledge, production systems and the exploitation of intangible assets.

Measures of organizational efficiency compare some aspect of unit performance to costs incurred (Campbell, 1981). Measures of organizational efficiency include performance; profit, quality, number of accidents, growth, absenteeism, turnover, job satisfaction, motivation, morale, conflict and cohesion, flexibility and adaptation in response to environmental changes, planning and goal setting, goal consensus, internalization of organizational goals, role and norm congruence, managerial, interpersonal and task skills, information management and communication, readiness, utilization of environment, evaluation of external entities, stability, training and development emphasis and achievement emphasis.

Several indicators of organizational efficiency and effectiveness that are listed in the framework are taken from a paper by Finlay (1991).

**Organizational effectiveness**

Cash generation  
Growth  
Innovation  
Market share  
Profitability  
RoI  
Technical excellence  
Adaption/Response to “the new”

**Organizational efficiency**

Communication  
Control
Cost savings
Productivity
Teamwork
Time savings

Process performance indicators

The term "process performance indicators" (PPIs) describes those variables concerned with measuring the quality of the process. The importance of the process has been stressed by a number of authors. McCartt and Rohrbaugh (1989) believe that the need for an assessment of the effectiveness of a group decision process requires attention to be directed to the process. Keen and Scott Morton (1978) maintain that, even though the ideal measures for evaluating a system that aims at better decisions is the actual result of the decisions, it is important to evaluate the way decisions are made. This is done irrespective of the output of the decisions; the argument being that better decisions will occur if the process by which they are reached is improved. Clearly, there is no definite proof that the new method of arriving at a decision is better.

PPIs are subdivided into two categories; firstly, those variables that measure aspects of the process itself and secondly, those variables that measure the attitudes of the group members to the group process. These two categories have been termed, respectively, "tangible process performance indicators" and "intangible process performance indicators".

Each of the variables can apply to a project, meeting, task or subtask depending on the stage at which the outcomes are being assessed. However the term task will be used to cover all the previous terms.

Tangible process performance indicators

Time taken

This is the time taken to complete the group’s work (Dennis et al., 1988).
Members' participation

This refers to the number of group members participating in each session of the group problem solving process (Jarvenpaa et al., 1988) and the equality of the participation. The opportunity for participation by members has been shown to influence greatly the group outcomes. Gear (1993) argues that group members always leave the meeting in a happier frame of mind if they have had the opportunity to contribute their views. This is an important consideration because if a group member leaves a meeting feeling unhappy, their disillusionment with the process will influence their participation in future meetings. As discussed previously, an individual’s degree of participation in the group’s interaction can be affected by their social position in the group (McGrath, 1984).

Depth of analysis

This variable assesses the number of alternatives generated and examined (Keen, 1986) and the number and complexity of criteria used to evaluate these alternatives (Pinsonneault and Kraemer, 1989).

Generation of ideas

This variable is concerned with the degree to which participants felt they generated more ideas as a result of the decision process they used (Nunamaker et al., 1989). Creativity of the process is an important factor to consider (Eden, 1992a).

Consensus reached

This refers to the degree of consensus reached by the group in arriving at a solution (Dennis et al., 1988; Nunamaker et al., 1988). In some cases the group may have a pre-specified level to which consensus is required, for example, consensus may be preferred or mandatory (Gray et al., 1990).

Consensus is concerned with the degree of personal commitment members have to a solution once it has been made and is a necessary condition in order to obtain effective results from the decisions (Zaleznik and Moment, 1964). It is possible for
members to disagree with a decision in principle, but to accept it and carry out their part. Thus, there is a need to distinguish between different degrees of consensus, for example, “I totally agree” as opposed to “I will accept that decision because it is for the common good” (Facilitator, 1992).

The emotional commitment the member feels towards the group influences a member’s willingness to put a decision plan into effect. In those situations where there is majority rule or a need to appease a strong superior which has determined the process outcome, uncommitted minority members or those with hostility towards the leader can make a solution fail by either deliberately or inadvertently not doing what the solution implies they should do. If are a group member is not emotionally involved with a decision they have little to lose if it fails (Zaleznik and Moment, 1964).

A slightly different view of consensus is offered by Friend and Hickling (1987). They discuss how what is required is a “convergence of views towards a common understanding” of the issue area. For there to be any sort of commitment, there must be some degree of shared perceptions concerning the issues, the solutions available and their likely consequences. This leads to a co-ordinated set of feasible recommendations which are supported by all group members.

**Meeting interest**

This is concerned with the degree to which the meeting is enlivened as a result of using a particular process (Kraemer and King, 1988). Eden (1992a) feels there is a need to enhance the entertainment factor of using GDSS.

**Intangible process performance indicators**

These variables are associated with group members feelings towards various aspects of the group process and outcomes. They are seen as intangible outcomes of the group process and are difficult to quantify. Friend (1990) uses the term “invisible” products of a group process to describe some of these variables. These “invisible products” are concerned with learning and adaptation by individual members and can have a
profound influence in the longer term (Friend and Hickling, 1987). These invisible products do not have an immediate impact; their full worth is appreciated over a period of time, for example, by more effective working in the future (Friend and Hickling, 1987). Friend and Hickling (1987) stress that these products are likely to escape unnoticed unless explicit efforts are made to help participants become aware of them. In Strategic Choice this is achieved by allowing the group an opportunity for reflection at the end of the group process.

Intangible process performance indicators are divided into three subcategories.

**Attitudes towards process**

**Satisfaction with the process**

This is the degree of satisfaction felt by the group members with the process used to achieve the group’s aims (Connolly et al., 1990; Dennis et al., 1988; Nunamaker et al., 1989). It will be influenced by the group’s success in achieving its objectives (Collins and Guetzkow, 1964).

**More intelligent decisions**

This is the degree to which participants feel that the decisions made were more intelligent as a result of using a particular decision process (Eden, 1988).

**Extending competences**

This refers to the degree to which participants feel they have gained competences as a result of participating in the decision process used to achieve the group’s aims (Robinson, 1990). Martz (1993) suggests that changes may occur in group member’s decision-making ability as a result of using a GDSS.

**Insights and learning**

Keen (1986) suggests that group members gain insights and learning regarding the operations of the company as a result of the experience of working with other group members (Keen, 1986). Group members can gain an understanding of other peoples’
values and ways of working (Friend and Hickling, 1987).

**Amount of emotion**

This refers to the degree to which personalized feelings are present in the meeting and the amount of emotion felt in the meeting (Facilitator, 1992). The more a situation is depersonalized and emotions are removed, the more likely it is for the group to achieve its objectives (Facilitator, 1992).

**Understanding of business**

This is the degree to which participants feel they gained a greater understanding of the organization’s business and the environment in which it operates as a result of working with the group (Keen, 1986).

**Attitude towards process outcomes**

**Acceptance**

This refers to the participants’ acceptance of the final decisions (Pinsonneault and Kraemer, 1989).

**Comprehension**

This variable is concerned with group participants’ comprehension of the final decisions (Pinsonneault and Kraemer, 1989).

**Satisfaction**

Group member satisfaction with the solutions reached is one of the most common post-process measures (Jarvenpaa *et al.*, 1988; Connolly *et al.*, 1990; Dennis *et al.*, 1988).

**Confidence**

This refers to the participants’ confidence in the final decisions (Gallupe and DeSanctis, 1988; Keen, 1986).
Ownership

The term “ownership” refers to the degree to which individual participants feel they own the final decision. Ownership of the decision is enhanced by participation of members in the decision making process (Baskin and Aronoff, 1980).

Commitment of group members

This variable is concerned with the commitment of participants to implementing the final solutions reached using the GDSS (Eden, 1992a). Eden (1992a) when discussing the commitment of participants to implementing the solutions, differentiates between emotional and cognitive commitment where the former occurs as a result of increased participation in decision-making while cognitive commitment comes from a recognition of substantive rationality, that is, the decision makes sense (Eden, 1992a). A member’s commitment to the decision is enhanced by their participation in the process (Baskin and Aronoff, 1980).

Friend and Hickling (1987) discuss the idea of a “commitment package” as a means of moving forward in a decision process. This commitment package includes not only substantive actions but also any explorative actions which are required to deal with areas of uncertainty surrounding the decision so as to enable future decision choices. The package also indicates those decision areas which are to remain open at present and possibly when, and how these deferred choices will be dealt with. They stress that commitment should be seen as a variable rather than as an all or nothing term. If the members come from different organizational departments or from different organizations, then a mutual commitment package is desired which brings together the actions required from all members, with each set of participants having their own commitment packages within their own sphere of responsibility, but to which all members are committed. The parts of the mutual commitment package can be merged to form a composite view of the way forward.

Friend (1993) also highlights those situations where members are unable to commit themselves freely to the outcomes as they represent interests from different organizations. To Friend (1993), for whom the majority of workshops involve
members of different organizations, these aspects of accountability and commitment of group members are very important.

Janis and Mann (1977), like Friend and Hickling (1987), also dismiss the view of commitment as an “all-or-nothing affair”. They discuss the usefulness of subdividing large, seemingly insurmountable problems into sets of manageable, small issues and gaining a series of small commitments to each of these which will result in a package deal.

The need for commitment enters into decisional dynamics both before and after the decision is made (Janis and Mann, 1977). The quality of thought processes brought to bear on a problem during the early predecisional stages is influenced by cues that warn the participants that they will be bound to the decision. Following commitment, the more negatively a member perceives the anticipated consequences of implementing a decision, the greater the postdecisional dissatisfaction experienced.

**Attitude towards group**

**Willingness to work with group again**

This is the extent to which participants are willing to work with the group again (Jessup and Tansik, 1991). The degree of cohesion within the group can influence this variable (Kraemer and King, 1988).

**Hedonic tone**

This variable is concerned with the degree to which group membership is accompanied by a general feeling of pleasantness or agreeableness (Hemphill, 1956).

**Teamwork**

The aim of the GDSS is to overcome process losses which occur as a result of a group of people working together. The use of a GDSS should result in more effective teamwork (Keen, 1986).
Post work

Post work is concerned with the various work assignments that need to be carried out by group members at the end of a group process and sometimes in preparation for the next meeting. Post work consists of three subcategories of variables.

Issue resolution

This is concerned with the problems and issues that arise as a result of the group process, but which are unresolvable at the time (Facilitator, 1992). It entails allocating specific tasks to particular group members who are expected to report their findings either to the rest of the group or to particular individuals.

Administrative details

This refers to the processes by which outcomes of the group process are communicated efficiently to significant others outside the group (Facilitator, 1992). It entails allocating specific tasks to group members and also covers the practicalities of dealing with the visible products of the process such as documentation and handling of flip charts (Friend and Hickling, 1987). Friend and Hickling (1987) stress this as one area of crucial significance which is often overlooked. By neglecting to report progress made by the group, the group's work may lose credibility or the commitment by others to carry out its recommendations.

Assessment of group process

An important aspect of post-process work is the assessments made of the group process. These assessments often take the form of questionnaires (see section 4.1 to 4.3). Dallavalle et. al. (1992) stated that facilitators found the use of quantitative collection tools, such as questionnaires, and qualitative feedback, from the meeting originator and participants, are important for improving the effectiveness of GDSS. Gear (1993b) stresses the need to specify the protocol for feeding back results of process assessments to the group.

Assessment of the process at each stage can provide the group with milestones to
show the group that they have achieved something; flipcharts provide one way of doing this (Ackermann, 1993). Ackermann (1993) stresses the need for the group to be “creative and then reflective”.

Review

This appendix has presented the framework which has been devised to illustrate those variables which characterize a group process. Each of the input, process and output variables has been examined and evidence has been provided from the literature, to support the inclusion of each variable. This framework has been used to produce the questionnaire developed in the current research.
Appendix Two

Original Questionnaire

This appendix presents the original version of the questionnaire which was completed by group members attending GDSS supported meetings. It is the data gathered using this questionnaire upon which the statistical tests described in Chapter Five were performed.
Meeting Process Survey

Loughborough University

Business School
Introduction

This questionnaire has been developed to evaluate your feelings towards the meeting in which you have just participated. The questionnaire is concerned with the process of the meeting rather than the content of the meeting. The way the group approaches its decision-making has been termed throughout this questionnaire as the "meeting process".

Today's meeting was conducted using a process which has been designed to support a group of people making decisions. The process you have used alters the way your group approaches decision-making compared with a conventional meeting. This questionnaire asks for your views on a number of different aspects of the meeting process. Your feelings towards the meeting process are a very important way of assessing the benefits of today's meeting process.

Completing the Questionnaire

It is important for the survey that you answer all the questions as honestly and as fairly as you can. There are no right or wrong answers and usually the first answer that comes to mind is the best. Please complete the questionnaire by yourself. Your responses are completely anonymous. The questionnaire should take around 20 minutes to complete.

Thank you very much for taking part in this survey and for your help in the evaluation of meeting processes.

Section A Characteristics of The Meeting Process

This section is concerned with your views on certain characteristics of the meeting process you have just used.

1. Please indicate your level of agreement to the following 4 statements.

<table>
<thead>
<tr>
<th>The process we used today favoured ...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A creative, flexible and innovative ways to make decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B the use and analysis of facts and information in order to reach decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C full participation by all members in extended discussions with open expression of feelings to make decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D a logical, efficient and reasoned approach to reach decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

2. Which of the 4 statements (A - D) above do you think best describes today's meeting process?
(please circle appropriate letter)

A
B
C
D
3a. How happy were you with the process you used in today’s meeting?  
(please circle your choice)

<table>
<thead>
<tr>
<th>very unhappy</th>
<th>unhappy</th>
<th>neither happy nor unhappy</th>
<th>happy</th>
<th>very happy</th>
</tr>
</thead>
</table>

3b. Please give the reason(s) for your answer:

4a. Please indicate your level of agreement to the following 3 statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A I think the process we used today helped the group focus on the key issues under discussion.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B I felt the facilitator intervened frequently during the meeting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C I think the facilitator should have intervened more frequently.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

4b. Please give the reason(s) for your answer to statement C:
Section B  Your Feelings about the Process

This section relates to your views on a number of possible intangible effects of using a meeting process.

5. Please indicate your level of agreement to the following 6 statements.

As a result of the meeting process we used today...

<table>
<thead>
<tr>
<th>Statement</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  I feel that my ability to do my job has been enhanced.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B  I feel that I have gained new insights and learning into the operations of the company.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C  I feel that we as a group were able to make better, more informed decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D  I feel that the discussions within the group were less emotive.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E  I feel that the influence of individual group member’s personalities upon discussions was decreased.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F  I feel that my understanding of the general business environment in which my organization operates has increased.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

6. Of the 6 statements (A-F) above:
   a) which represents the most significant benefit you gained from using today’s meeting process?
      (please circle appropriate letter)

      A  B  C  D  E  F

   b) which represents the benefit you would most like to gain from using a meeting process?
      (please circle appropriate letter)

      A  B  C  D  E  F

7. Please list any other benefit(s) you felt you gained from using today’s meeting process.
Section C  Your Attitude to the Decisions Made

This section is concerned with your views on how the meeting process used today affected your feelings towards the decisions made.

8. Please answer the following questions.

<table>
<thead>
<tr>
<th>Compared to your feelings from previous meetings, how has using today’s meeting process influenced your..</th>
<th>greatly decreased</th>
<th>somewhat decreased</th>
<th>made no difference</th>
<th>somewhat increased</th>
<th>greatly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A acceptance of the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B understanding of the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C confidence in the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D feelings of ownership for the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E commitment to implementing the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

9. Of the 5 statements (A-E) above:
   a) which represents the greatest change in your feelings towards today’s decisions as a result of using today’s meeting process?
      (please circle appropriate letter)

   b) which represents the most important feeling you would like to have towards the decisions made in a meeting?
      (please circle appropriate letter)

10. Please list any other benefit(s) you gained from using today’s meeting process with respect to the decisions made.
Section D Effects of the Process on the Group

This section is concerned with your views of the effects of using today's meeting process on feelings within the group.

11. Please answer the following questions.

<table>
<thead>
<tr>
<th>Compared to previous meetings you have participated in, how has using today's meeting process influenced...</th>
<th>greatly decreased</th>
<th>somewhat decreased</th>
<th>made no difference</th>
<th>somewhat increased</th>
<th>greatly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A your willingness to work with the group again?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B the feeling of teamwork within the group?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C the feeling of pleasantness and agreeableness within the group?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D the feeling of group spirit within the group?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

12. Of the 4 statements (A-D) above, in your view:
   a) which represents the greatest change in group feelings as a result of using today’s meeting process?
      (please circle appropriate letter)
      A   B   C   D
   b) which represents the most important feeling the group should gain as a result of using a meeting process?
      (please circle appropriate letter)
      A   B   C   D

13. Please list any other factor(s) concerning the group which you felt were influenced as a result of using today's meeting process.
Section E: Assessing the Process

This section is concerned with your views relating to how today’s meeting may have differed from a conventional meeting, that is, one in which no meeting process is used.

14. Please compare today’s meeting with a conventional meeting and then rate today’s meeting according to the statements below.

<table>
<thead>
<tr>
<th></th>
<th>much less than conventional meeting</th>
<th>a little less than conventional meeting</th>
<th>no different from conventional meeting</th>
<th>a little greater than conventional meeting</th>
<th>much greater than conventional meeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Time taken to reach decision.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>Percentage of total group members participating in discussions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>Opportunity for group members to participate in discussions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>Number of alternative decisions considered.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>Number of criteria used to evaluate the alternative decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>The number of ideas generated by the group.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

15. Of the 6 statements (A-F) above please indicate which you feel represents the greatest difference between today’s meeting and a conventional meeting.
(please circle appropriate letter)

A

B

C

D

E

16. This question asks you to indicate your agreement to a number of statements relating to meetings in general and not specifically to today’s meeting process.

<table>
<thead>
<tr>
<th>In my view it is important in decision-making meetings that...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A the group takes as little time as possible to reach decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B a large percentage of group members contribute to the discussions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C all group members are given an equal opportunity to participate in discussions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D the group considers a large number of alternative decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E the group evaluates the alternative decisions using a large number of criteria.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F the group generates a large number of ideas.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix Two: The Original Questionnaire

17. Of the 6 statements (A-F) above which do you think it is most important to attain from using a meeting process? (please circle appropriate letter)

A       B       C       D       E       F

18a. Please indicate your level of agreement to the following 7 statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Using today’s meeting process heightened my interest in the meeting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B The group reached a high degree of consensus.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C The meeting process we used today helped the group to reach consensus on the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D I have a strong interest in the issues under discussion.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E Today’s meeting process made the meeting more entertaining.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F The meeting process we used today helped the group build commitment to implementing the decisions made.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>G I found today’s meeting process novel.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

18b. If you circled 4 or 5 to statement G, then please indicate your level of agreement to the following 2 statements, otherwise please go on to section F.

<table>
<thead>
<tr>
<th>Statement</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A I found that the novelty of the process distracted my attention from the issues under discussion.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B I found that the novelty of the process stimulated my interest in the meeting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Section F Characteristics of the Decisions Made

This section is concerned with your feelings towards the decisions reached.

19. Please indicate your level of agreement to the following 4 statements.

<table>
<thead>
<tr>
<th>The decisions we made as a group ...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A are legitimate and fair decisions which will be acceptable to those outside the meeting who will be affected by the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B can be fully accounted for by the facts and information used to make the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C are fully supported by the group as a whole.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D are rational decisions which take into account organizational goals and objectives.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

20. Which of the 4 statements (A-D) above do you think best describes the decisions the group made today? (please circle appropriate letter)

   A   B   C   D

21a. How happy were you with the decisions you made as a group? (please circle your choice)

   very unhappy       unhappy       neither happy nor unhappy       happy       very happy

21b. Please give the reason(s) for your answer:
22. Please indicate your level of agreement to the following 6 statements.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The decisions we made today are effective decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>The decisions can be practically implemented.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>Implementing the decisions we have made will bring about the changes intended by the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>The group made good quality decisions in terms of the amount of time spent reaching the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>The meeting was productive.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>F</td>
<td>The group is committed to implementing the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

23. To what extent did the group achieve its objectives?  
(please circle your choice)

not at all to a minor extent to a major extent fully

Section G Overall Feelings of Satisfaction

This section relates to general aspects of your satisfaction both with the process you used today and with the decisions made.

24. Please indicate your level of agreement to the following 3 statements.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The process we used as a group to make decisions made sense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>The decisions we made as a group made sense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>I would like to use the meeting process we used in a future meeting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

25a. What is your overall level of satisfaction with the meeting process you as a group used today?  
(please circle your choice)

strongly dissatisfied dissatisfied neither satisfied nor dissatisfied satisfied strongly satisfied
25b. What gave you most satisfaction from using the meeting process?
(for example, plenty of opportunity to contribute your ideas to the discussion, efficiency of the process)

25c. What did you not like about the meeting process?
(for example, too much time was spent on understanding the process rather than discussing the pertinent issues, the discussion was dominated by a minority of group members)

26a. What is your overall level of satisfaction with the decisions you as a group made in the meeting?
(please circle your choice)

   strongly dissatisfied  dissatisfied  neither satisfied nor dissatisfied  satisfied  strongly satisfied

26b. What satisfied you most about the decisions the group made?
(for example, quality of the decisions made, the decisions reflect inputs from all the group members)

26c. What did you not like about the decisions the group made?
(for example, decisions do not have the commitment of all the group members, the decisions are not workable)
27. Including today, how many times have you attended a meeting which has used the same meeting process as the group used today?

Number of times  

28. Including today, how many times have you attended a meeting which has used some sort of designed meeting process?

Number of times  

29. If you have any other comments concerning today's meeting process please write them in the space below.

30. Did you have any problems with completing the questionnaire? If so can you briefly explain why. If you had difficulties with particular questions please give the question numbers and the difficulties you had.

(for example, the meaning of the question was unclear, the question was badly worded).

Thank you for taking the time to complete this questionnaire. Your responses are of enormous value to the study of the benefits of meeting processes.

********************
Appendix Three

Facilitator’s Form

This appendix presents the facilitator’s form which was completed by the facilitator for each of the meetings for which respondents completed questionnaires. From the data collected using these forms the meetings descriptions presented in Appendix Four were written.
Meeting Process Survey

Facilitators Form

Loughborough University

Business School

This document consists of 2 parts. The first part asks you for factual information about the meeting and the second part consists of two questions selected from the group members questionnaire. Throughout this questionnaire the term “facilitator” has been used to refer to the person(s) running the meeting.
Meeting Situation

Introduction

These questions aim to gather some background information to the meeting which the group members have evaluated. This information will be beneficial for putting the group members' questionnaire responses into context. Please answer these questions as fully as possible. Many of the questions require you only to circle the appropriate answer.

Section A Organization

Name of organization

Business of organization

Section B Meeting Process Used

Please give brief details on the process used in this meeting, including its name and how the process supports the group in its decision-making.

Was the meeting process run by someone from inside the company? yes / no (please circle your choice)

Does the process allow for any anonymity within the meeting? yes / no (please circle your choice)

Did the meeting process involve the use of computers? yes / no (please circle your choice)

If yes, please give brief details.
Were group members asked to do any preparation work prior to the meeting?  
(please circle your choice)

Section C Meeting Personnel

Number of group members present:

Male □ Female □

Reasons for group membership: voluntary / involuntary

(please circle your choice)

All group members were working towards: same goals / different goals

(please circle your choice)

Has this particular group met before for a meeting? yes / no

(please circle your choice)

Section D Characteristics of the Group

1. Management Height
   This refers to the number of management levels the group members represent, for example non-management, lower-, middle, senior-management. If you know the exact number of management levels present, please enter that number in the box. Otherwise on a scale of 1 to 5 (5 being the highest) rank the group on its management height by circling the appropriate number.

   Height □

2. Group width
   This refers to the number of different organizational functions, departments or sites represented by the group members. If there are known numbers of functions, departments or sites represented please enter those numbers in the boxes. Otherwise on a scale of 1 to 5 (5 being the highest) rank the group as to its width by circling the appropriate number.

   Width □

3. Homogeneity of the group
   This refers to the degree to which the group can be said to be composed of similar persons. On a scale of 1 to 5 (5 being the highest) rank the group's homogeneity by circling the appropriate number.

   Homogeneity □
Appendix 3: Facilitator's Form

5. Are group members personally accountable for decisions made or must the decisions be approved by people outside the meeting before they can be implemented?

- members personally accountable / decisions must be approved by others

(please circle your choice)

6. Is there an identifiable leader within the group?

- yes / no

(please circle your choice)

7. Is there an identifiable member(s) within the group who hold power?

- yes / no

(please circle your choice)

8. Please enter the number of people present in the meeting in the appropriate boxes below.

- Number of group members
- Number of facilitators
- Number of observers
- Others

9. Please briefly state the aims of the meeting.

10. How urgent were the aims of the meeting?

- very / fairly / not at all

(please circle your choice)

11. How complex were the aims of the meeting?

- very / fairly / not at all

(please circle your choice)

12. Is this meeting part of a series of meetings?

- yes / no

(please circle your choice)

13. Approximately how long did this meeting last?

Section F Meeting Room

14. Where was the meeting held?

- off-site / on-site

(please circle your choice)
5. How was the seating arranged?  in rows / horseshoe / circle / other (please circle your choice)

6. Please indicate whether the following facilities were available or not and then rate them against the criteria in the table. If the facility was not present and you would have liked it to have been, please mark this as “preferred”.

<table>
<thead>
<tr>
<th>Facility</th>
<th>Available</th>
<th>Not Available</th>
<th>Good</th>
<th>Adequate</th>
<th>Poor</th>
<th>Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>flip charts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>white boards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHP (Over Head Projector)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wall hanging space</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>size of room for number of participants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>temperature of room</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>natural lighting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>artificial lighting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>desk space</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appropriately-positioned computer monitors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>telephone for group members use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>main meeting room and syndicate/ breakout rooms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>refreshments</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This completes the factual questions concerning the meeting. Thank you for your answers.
Meeting Process Survey

Introduction

These questions ask you to evaluate characteristics of today’s meeting process and of the decisions reached by the group as a result of using the process.

Section A Characteristics of The Meeting Process

Please consider the following 4 statements.

A creative, flexible and innovative way to make decisions.
B the use and analysis of facts and information in order to reach decisions.
C full participation by all members in extended discussions with open expression of feelings to make decisions.
D a logical, efficient and reasoned approach to reach decisions.

Which of the 4 statements (A-D) above do you think best describes today’s meeting process?

Please circle appropriate letter)


Section B Characteristics of the Decisions Made

Please consider the following 4 statements.

A are legitimate and fair decisions which will be acceptable to those outside the meeting who will be affected by the decisions.
B can be fully accounted for by the facts and information used to make the decisions.
C are fully supported by the group as a whole.
D are rational decisions which take into account organizational goals and objectives.

Which of the 4 statements (A-D) above do you think best describes the decisions the group made today?

Please circle appropriate letter)


Thank you for taking the time to complete this questionnaire.

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Appendix Four

Meeting Descriptions

This section presents a description of those companies and meetings for which participants completed questionnaires. The information represents the input variables of the research framework and was collated from the facilitator’s form. Each facilitator was asked to assess the facilities available to the group as either good, adequate or poor. If a facility was not available, the facilitator was asked to indicate if they would have preferred that facility to have been available.

Organization 1

Organization 1 operates in a financial environment in which there are many competitors.

This particular group had met before and had, therefore, negotiated the initial stages of group development and social networks existed. All group members were working towards the same goals. Members were personally accountable for the decisions made. There was an identifiable leader within the group and an identifiable member held power. There were 2 levels of management present with 9 separate functions represented from 2 sites. The group were ranked as fairly homogeneous with a ranking of 4 out of 5. There were 10 members present, 8 male and 2 female. The size of the room was judged as good. Membership to the group was involuntary.

The group support was a manual process led by 2 facilitators. The process used consisted of:

1. structured questions to lead the discussion;
2. De Bono’s “6 thinking hats” to encourage creative thinking;
3. voting (in relation to preferences identified in 2.);
4. strategic planning models for developing feasible plans using preferences identified in 3.

The meeting was run by in-house facilitators. The process did not allow for anonymity and did not involve the use of computers. The meeting was held off-site. Seating was arranged in a horseshoe.

The aims of the meeting were:
1. to identify shared values/common purpose as a basis of a vision statement;
2. to analyse the competitive arena;
3. to agree the key objectives for next 3 years (from a pre-defined list);
4. to explore generic strategies and feasible strategic options.

The aims of the meeting were considered very urgent and very complex. This meeting lasted 8 hours and formed part of a series of meetings. Group members were asked to do some pre-meeting preparation work.

The assessment by the facilitator of the facilities available to the group is shown in the table overleaf.
### Organization 2

Organization 2 is an engineering firm specializing in a field with few competitors. Questionnaires were completed by group members attending 2 meetings within this organization.

#### Meeting 1

This group had met before and all members were working towards the same goals. Members were personally accountable for the decisions made in the meeting. There was no identifiable leader or person with power in the group. The group was composed of a single management level with 5 different departments represented from 3 different sites. The homogeneity of the group was ranked as 2 out of a possible ranking of 5. There were 12 group members present, 9 male and 3 female. The size of the room was judged as adequate. Membership to the group was voluntary.

The process used was a manual process known as JAD (Joint Application Development).

---

<table>
<thead>
<tr>
<th>Facility</th>
<th>Available</th>
<th>Not Available</th>
<th>Good</th>
<th>Adequate</th>
<th>Poor</th>
<th>Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>flip charts</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>white boards</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OHP (overhead projector)</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wall hanging space</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>size of room for number of participants</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>temperature of room</td>
<td></td>
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<td>*</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>natural lighting</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>artificial lighting</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>desk space</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appropriately-positioned monitors</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>telephone for group members' use</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>main meeting room and syndicate/ break-out rooms</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>refreshments</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Development) led by a facilitator with a documentor (or scribe) present. The process as described by the facilitator involves an impartial facilitator ensuring that objectives are fully and clearly stated and communicated to participants prior to the session. Participants are met prior to the session to resolve any issues which may jeopardise the outcome. A workshop is held during which all decisions are documented and kept on view to the participants which helps build consensus. The decisions are documented and circulated to all participants at, or soon after, the workshop.

The process was run by an in-house facilitator. It does not allow for anonymity but does use computers for documenting the process. A documentor uses a laptop computer to duplicate the group decisions which had been recorded on flip charts and the whiteboard. The decisions are recorded in “a more readable state” but the essence is not altered. This enables the rapid production of a document of the proceedings for the participants. Members were asked to do some work prior to the meeting. The meeting was held off-site with a horseshoe seating arrangement.

The aims of the meeting were to determine an agreed corporate process and supporting data requirements for a function of the business and to run business sessions through the model to confirm it. The aims were very urgent and very complex. The meeting lasted for 3 days and formed part of a series of meetings.

The table overleaf shows the facilitator’s assessment of the facilities available to the group.
### Meeting Descriptions

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### Meeting 2

This group had met before. All group members were working towards the same goals. There was an identifiable leader within the group and an identifiable person held power. The group consisted of 3 management levels with 8 different departments represented from 2 sites. The homogeneity of the group was ranked fairly low at 2. There were 15 members present, 13 male and 2 female. The size of the room was judged as adequate. Membership to the group was voluntary.

The process used was the JAD process as previously described. One facilitator and one documentor was present. The aims of the meeting were to review and revise a system specification which had been determined by the same group at an earlier workshop (4 months earlier). The aims were considered fairly urgent and fairly complex. This meeting lasted 8.5 hours and formed part of a series of meetings. Group members were asked to do some preparatory work. The meeting was held off-site. The seating arrangement was in a horseshoe.
The table below shows the facilitator's assessment of the facilities available to the group.

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**Organization 3**

Organization 3 is a District Council which operates in an environment with no competitors.

This particular group had met before. All group members were working towards the same goals. The decisions the members made must be approved by others. There was an identifiable leader within the group and an identifiable person held power. The group were ranked as being of 1 management level although 2 levels were present on day 1 of the meeting. Three departments were represented at the meeting, all from one site. The group was ranked as homogeneous with a rating of 5 out of a possible 5. The group comprised 4 participants but there were 5 present on day 1. The size of the room was rated as good. Membership to the group was involuntary.

The process used was Decision Conferencing led by a facilitator with the help of an analyst/modeller. The process was described by the facilitator as follows. "The
process was developed as the meeting progressed. The facilitator guided the discussion process for identifying and gathering views on budget objectives and issues of contention. Analysis and evaluation of problems and solutions was carried out using a standard spreadsheet model.” The process allows for anonymity in the meeting and uses computers to run the spreadsheet model.

The meeting was run by a facilitator from outside the organization. Group members were asked to do some work prior to the meeting. The aims of the meeting were to review the Revenue Budget and recommend to members steps to improve the performance of the Council against stipulated targets. The aims were considered very urgent and very complex. The meeting lasted 3 days and did not form part of a series of meetings. The meeting was held on-site. Seating was arranged in a horseshoe.

The table below shows the facilitator’s assessment of the facilities available to the group.

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Organization 4

Organization 4 is a Metropolitan Borough Council which operates in a non-competitive environment.

This particular group had met before. All group members were working towards the same goals. The decisions the group made had to be approved by others. There was an identifiable leader within the group and an identifiable person held power. The group comprised of 3 management levels. Ten different functions were represented from 2 different departments and 3 different sites. The group were relatively homogeneous, ranked as 4 out of a possible 5. The group consisted of 12 male and 1 female participant. The size of the room was rated as adequate. Membership to the group was involuntary.

The process used was Decision Conferencing run by a facilitator with the help of an analyst. The facilitator described the process used as follows.
1. Use of the Equity model of the Decision Conference Package.
2. The process is essentially a tool by which those responsible for the management and delivery of the specific services are able to, by an objective assessment of costs and benefits, arrive at an overall “best” value for money service level at any level of cost within a pre-determined range above or below current cost.
3. Outputs of evaluation are translated into service level options (with service consequences) for consideration by elected members.
4. The outputs from the services of decision conferences covering all services are then considered in the context of overall funding availability.

The process allows for anonymity within the meeting and involves the use of computers. ICL’s “Equity Model” of the Decision Conferencing Software runs on a laptop computer to produce the Decision Conference Model. A report is produced via a compatible personal computer. The meeting was run by a facilitator from outside the organization and was held on-site but not within the department normally occupied by the group members.
The aims of the meeting were:

1. to identify issues impacting upon 1995/96 Revenue Budget;
2. to reach a shared understanding of the options available to achieve Revenue Budget levels within the range +5% to -12.5%;
3. to evaluate these options for budget recommendations;
4. to generate an agreed set of options for budget for recommendation to committee members;
5. to identify any concerns over central support costs;
6. to agree proposals for possible "one-off" expenditure bids.

The aims were considered very urgent and very complex. The meeting lasted 2 days and formed part of a series of meetings. Members were asked to do some preparatory work. Seating was arranged in a horseshoe.

The table below shows the facilitator’s assessment of the facilities available to the group.

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Review

This appendix has presented a description of the meetings attended by group members who completed questionnaires.
Appendix Five

Research Hypotheses

Chapter Five identified the tests for reliability and validity to be carried out on the questionnaire. These tests will involve the analysis of respondents’ scores and will be based on hypotheses which will be discussed in greater detail.

The questionnaire has been developed directly from the framework which is itself composed of postulated causal linkages between variables. The description of the framework variables (see Appendix One) proposes the expected changes in the variables when a group uses a GDSS, which have been suggested in the literature. The questionnaire aims to assess group members’ perceptions of the process and outcome variables. By including these variables in the questionnaire, some of the hypotheses on which the framework is based are being tested. Tests for criterion-related validity, for example, will entail a comparison of scores from individual items with scores attained on global items which assesses whether the individual items are measuring the construct assessed by the global item and whether they are correlated. Factor analysis examines the underlying factors of a scale which account for the variance in group members’ scores. Therefore, it can be seen that the analyses carried out to test the questionnaire for validity also test the hypotheses upon which the questionnaire is based.

Several questions in the questionnaire do not test a hypothesis. These questions are concerned either with statements of fact about the process and outcomes or ask members for their reasons for particular answers.

The hypotheses on which the analysis is based are presented for each of the questions.
Where no hypothesis is tested, this is indicated. From the results of the statistical tests, conclusions are drawn concerning whether a hypothesis is supported, as indicated in this appendix. For some analyses the hypotheses were not tested statistically. The discussion of results in Chapter Seven gives further details of how the conclusions concerning the hypotheses were reached.

**Question 1:** No hypothesis.

**Question 2:** No hypothesis.

**Question 3a:** The happier the group member is with the process, the higher he/she should rate their happiness with the process.
This is a criteria or global question and so no hypothesis was tested.

**Question 3b:** No hypothesis.

**Question 4a:**
A: An agreement that the process the group used today helped the group focus on the key issues under discussion will result in group members' happiness with the process.
*Results of analysis:* hypothesis supported.
B: An agreement that the facilitator intervened frequently will result in group members' unhappiness with the process.
*Results of analysis:* hypothesis not supported.
C: An agreement that the facilitator should have intervened more frequently will result in group members' unhappiness with the process.
*Results of analysis:* hypothesis not supported.

**Question 4b:** No hypothesis.

**Question 5** (scale hypothesis): An agreement that group members gained intangible benefits from using the process will result in group members' happiness with the process.
A: An agreement that group members felt their ability to do their job had been enhanced will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported.
B: An agreement that group members felt they gained new insights and learning into the operations of the company will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported.
C: An agreement that group members felt the group were able to make better more informed decisions will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported.
D: An agreement that group members felt the discussions within the group were less emotive will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported.
E: An agreement that group members felt that the influence of individual group members’ personalities upon discussions was decreased will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported.
F: An agreement that group members felt that their understanding of the general business environment in which the organization operates has increased will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported.

Questions 6a and 6b: An agreement that the statement chosen by group members as representing the most significant benefit they gained from using the process is the same statement as that chosen to represent the benefit they would most like to gain will result in group members’ happiness with the process.  
Results of analysis: hypothesis supported (not statistically tested).

Question 7: no hypothesis

Question 8 (scale hypothesis): A perceived improvement in members’ attitudes towards the decisions made will result in group members’ happiness with the process.
A: A perceived increase in group members’ feelings of acceptance of the decisions made will result in group members’ happiness with the process.

Results of analysis: hypothesis supported.

B: A perceived increase in group members’ feelings of understanding of the decisions made will result in group members’ happiness with the process.

Results of analysis: hypothesis not supported.

C: A perceived increase in group members’ confidence in the decisions made will result in group members’ happiness with the process.

Results of analysis: hypothesis supported.

D: A perceived increase in group members’ feelings of ownership for the decisions made will result in group members’ happiness with the process.

Results of analysis: hypothesis supported.

E: A perceived increase in group members’ commitment to implementing the decisions made will result in group members’ happiness with the process.

Results of analysis: hypothesis supported.

Questions 9a and 9b: An agreement that the statement chosen by group members as representing the greatest change in their feelings towards the decisions as a result of using the process is the same statement as that chosen to represent the most important feeling they would like have towards the decisions made will result in group members’ happiness with the process.

Results of analysis: hypothesis supported (not statistically tested).

Question 10: no hypothesis.

Question 11 (scale hypothesis): A perceived improvement in members’ feelings towards the group will result in group members’ happiness with the process.

A: A perceived increase in group members’ willingness to work with the group again will result in group members’ happiness with the process.

Results of analysis: hypothesis supported.

B: A perceived increase in group members’ feelings of teamwork within the group will result in group members’ happiness with the process.
Results of analysis: hypothesis not supported.
C: A perceived increase in group members’ feelings of pleasantness and agreeableness within the group will result in group members’ happiness with the process.
Results of analysis: hypothesis supported.
D: A perceived increase in group members’ feelings of group spirit within the group will result in group members’ happiness with the process.
Results of analysis: hypothesis supported.

Questions 12a and 12b: An agreement that the statement chosen by group members as representing the greatest change in group feelings as a result of using the process is the same statement as that chosen to represent the most important feeling the group should gain as a result of the process will result in group members’ happiness with the process.
Results of analysis: hypothesis supported (not statistically tested).

Question 13: no hypothesis.

Question 14 (scale hypothesis): A perceived improvement by group members’ in aspects of the process compared to a conventional meeting will result in happiness with the process.
A: If the time taken to reach a decision is perceived by group members as being less than a conventional meeting, group members will be happy with the process.
Results of analysis: hypothesis not supported.
B: If the percentage of total group members participating in discussions is perceived by group members as being greater than a conventional meeting, group members will be happy with the process.
Results of analysis: hypothesis supported.
C: If the opportunity for group members to participate in discussions is perceived by group members as being greater than a conventional meeting, group members will be happy with the process.
Results of analysis: hypothesis supported.
D: If the number of alternative decisions considered is perceived by group members as being greater than a conventional meeting, group members will be happy with the process.

Results of analysis: hypothesis not supported.

E: If the number of criteria used to evaluate the alternative decisions is perceived by group members as being greater than a conventional meeting, group members will be happy with the process.

Results of analysis: hypothesis not supported.

F: If the number of ideas generated by the group is perceived by group members as being greater than a conventional meeting group members will be happy with the process.

Results of analysis: hypothesis supported.

Question 15: see question 17.

Question 16: No hypotheses.

Questions 15 and 17: An agreement that the statement chosen by group members as representing the greatest difference between today’s meeting and a conventional meeting is the same statement as that chosen to represent what group members consider to be the most important feeling to gain from using a meeting process, the group members will be happy with the process.

Results of analysis: hypothesis rejected (not statistically tested).

Question 18a: An agreement that group members gained other benefits from using the process will result in happiness with the process.

A: An agreement that using the meeting process heightened group member’s interest in the meeting will result in group members’ happiness with the process.

Results of analysis: hypothesis not supported.

B: An agreement that the group reached a high degree of consensus will result in group members’ happiness with the process.

Results of analysis: hypothesis supported.
C. An agreement that the meeting process helped the group reach consensus on decisions will result in group members' happiness with the process.

Results of analysis: hypothesis supported.

D. An agreement that group members have a strong interest in the issues under discussion will result in group members' happiness with the process.

Results of analysis: hypothesis not supported.

E. An agreement that the meeting process made the meeting more entertaining will result in group members' happiness with the process.

Results of analysis: hypothesis not supported.

F. An agreement that the meeting process helped the group build commitment to implementing the decisions made will result in group members' happiness with the process.

Results of analysis: hypothesis supported.

G. An agreement that group members found today's meeting process novel will result in group members' happiness with the process.

Results of analysis: hypothesis not supported.

Question 18b:

A: An agreement that group members found the novelty of the process distracted their attention from the issues under discussion will result in group members' unhappiness with the process.

Results of analysis: hypothesis could not be tested.

B: An agreement that group members found the novelty of the process stimulated their interest in the meeting will result in group members' happiness with the process.

Results of analysis: hypothesis not supported.

Question 19: No hypothesis.

Question 20: No hypothesis.

Question 21a: The happier the group member is with the decisions the higher he/she should rate their happiness with the decisions.
This is a criteria or global question and so no hypothesis was tested.

**Question 21b:** No hypothesis

**Question 22** (scale hypothesis): An agreement that group members gained other benefits with respect to the decisions will result in group members’ happiness with the decisions.

**A:** An agreement that group members perceived the decisions made as effective decisions will result in group members’ happiness with the decisions.

*Results of analysis:* hypothesis supported.

**B:** An agreement that group members perceived that the decisions can be practically implemented will result in group members’ happiness with the decisions.

*Results of analysis:* hypothesis not supported.

**C:** An agreement that group members perceived that implementing the decisions made will bring about the changes intended by the decisions will result in group members’ happiness with the decisions.

*Results of analysis:* hypothesis supported.

**D:** An agreement that group members perceived the group made good quality decisions in terms of the amount of time spent reaching the decisions will result in group members’ happiness with the decisions.

*Results of analysis:* hypothesis supported.

**E:** An agreement that group members perceived the meeting was productive will result in group members’ happiness with the decisions.

*Results of analysis:* hypothesis supported.

**F:** An agreement that group members perceived that the group is committed to implementing the decisions will result in group members’ happiness with the decisions.

*Results of analysis:* hypothesis supported.

**Question 23:** The greater the extent to which group members perceived the group achieved its objectives will result in group members’ happiness with the process.

*Results of analysis:* hypothesis supported.
Question 24.
A: An agreement that group members perceived the process used to make decisions made sense will result in group members' happiness with the process.
Results of analysis: hypothesis supported.
B: An agreement that group members perceived the decisions made by the group made sense will result in group members’ happiness with the process.
Results of analysis: hypothesis supported.
C: An agreement that group members would like to use the process in a future meeting will result in group members' happiness with the process.
Results of analysis: hypothesis supported.

Question 25a: The more satisfied the group member is with the process the higher he/she should rate their level of overall satisfaction with the process. This is a criteria or global question and so no hypothesis was tested.

Question 25b: No hypothesis.

Question 25c: No hypothesis.

Question 26a: The more satisfied the group member is with the decisions the higher he/she should rate their level of overall satisfaction with the decisions. This is a criteria or global question and so no hypothesis was tested.

Question 26b: No hypothesis.

Question 26c: No hypothesis.

Question 27: The fewer the number of times a group member has attended a meeting which has used the same process as used today will result in happiness with the process.
Results of analysis: hypothesis not statistically tested.
Question 28: The fewer the number of times a member has attended a meeting which has used some sort of decision process will result in happiness with the process.

Results of analysis: hypothesis not statistically tested.

Review

This appendix has presented the hypotheses that were tested in the course of analysing group members’ responses in order to establish reliability and validity of the questionnaire. The conclusions drawn from the results, concerning whether the hypotheses were supported or not, have been indicated.
Appendix Six

Revised Questionnaire

This appendix presents the revised version of the questionnaire after making the changes identified in the discussion of the statistical analysis (see Chapter Seven). Some of the questions, such as 6, 7 and 9, have been divided into sections according to the factors identified in the analysis from the Principal Components Factor Analysis.
Appendix Six: The Revised Questionnaire

Meeting Process Survey

Loughborough University

Business School
Appendix Six: The Revised Questionnaire

Introduction

This questionnaire has been developed to evaluate your feelings towards the meeting in which you have just participated. The questionnaire is concerned with the process of the meeting rather than the content of the meeting. The way the group approaches its decision-making has been termed throughout this questionnaire as the “meeting process”.

Today's meeting was conducted using a process which has been designed to support a group of people making decisions. The process you have used alters the way your group approaches decision-making compared with a conventional meeting. This questionnaire asks for your views on a number of different aspects of the meeting process. Your feelings towards the meeting process are a very important way of assessing the benefits of today's meeting process.

Completing the Questionnaire

It is important for the survey that you answer all the questions as honestly and as fairly as you can. There are no right or wrong answers and usually the first answer that comes to mind is the best. Please complete the questionnaire by yourself. Your responses are completely anonymous. The questionnaire should take around 15 minutes to complete.

Thank you very much for taking part in this survey and for your help in the evaluation of meeting processes.

Section A. Characteristics of The Meeting Process

This section is concerned with your views on certain characteristics of the meeting process you have just used.

1a. How happy were you with the process you used in today's meeting?  
(please circle your choice)

<table>
<thead>
<tr>
<th>very unhappy</th>
<th>unhappy</th>
<th>neither happy nor unhappy</th>
<th>happy</th>
<th>very happy</th>
</tr>
</thead>
</table>

1b. If you circled “very unhappy”, “unhappy” or “neither happy nor unhappy”, please give the reason(s) for your answer:

2. Please indicate your level of agreement to the following statement.

<table>
<thead>
<tr>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>I think the process we used today helped the group focus on the key issues under discussion.</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

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Section B  Your Feelings about the Process

This section relates to your views on a number of possible intangible effects of using a meeting process.

3. Please indicate your level of agreement to the following 6 statements.

<table>
<thead>
<tr>
<th>As a result of the meeting process we used today...</th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A I feel that my ability to do my job has been enhanced.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B I feel that I have gained new insights and learning into the operations of the company.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C I feel that my understanding of the general business environment in which my organization operates has increased.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D I feel that the discussions within the group were less emotive.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>E I feel that the influence of individual group member's personalities upon discussions was decreased.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>F I feel that we as a group were able to make better, more informed decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Section C  Your Attitude to the Decisions Made

This section is concerned with your views on how the meeting process used today affected your feelings towards the decisions made.

4. Please answer the following questions.

<table>
<thead>
<tr>
<th>Compared to your feelings from previous meetings, how has using today's meeting process influenced your...</th>
<th>greatly decreased</th>
<th>somewhat decreased</th>
<th>made no difference</th>
<th>somewhat increased</th>
<th>greatly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A acceptance of the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B confidence in the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C feelings of ownership for the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D commitment to implementing the decisions made?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Appendix Six: The Revised Questionnaire

Section D  Effects of the Process on the Group

This section is concerned with your views of the effects of using today's meeting process on feelings within the group.

5. Please answer the following questions.

<table>
<thead>
<tr>
<th>Compared to previous meetings you have participated in, how has using today's meeting process influenced ...</th>
<th>greatly decreased</th>
<th>somewhat decreased</th>
<th>made no difference</th>
<th>somewhat increased</th>
<th>greatly increased</th>
</tr>
</thead>
<tbody>
<tr>
<td>A your willingness to work with the group again?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B the feeling of teamwork within the group?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>C the feeling of pleasantness and agreeableness within the group?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>D the feeling of group spirit within the group?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Section E  Assessing the Process

This section is concerned with your views relating to how today's meeting may have differed from a conventional meeting, that is, one in which no meeting process is used.

6. Please compare today’s meeting with a conventional meeting and then rate today’s meeting according to the statements below.

| | much less than conventional meeting | a little less than conventional meeting | no different from conventional meeting | a little greater than conventional meeting | much greater than conventional meeting |
|-------------------------------|-----------------------------------------|----------------------------------------|------------------------------------------|-----------------------------------------|
| A Percentage of total group members participating in discussions. | 1 | 2 | 3 | 4 | 5 |
| B Opportunity for group members to participate in discussions. | 1 | 2 | 3 | 4 | 5 |
| C Time taken to reach decision. | 1 | 2 | 3 | 4 | 5 |
| D The number of ideas generated by the group. | 1 | 2 | 3 | 4 | 5 |

7. Please indicate your level of agreement to the following 7 statements.

| | strongly disagree | disagree | neither agree nor disagree | agree | strongly agree |
|-------------------------------|------------|---------------------------|-------|----------------|
| A The group reached consensus on the decisions. | 1 | 2 | 3 | 4 | 5 |
| B The meeting process we used today helped the group to reach consensus on the decisions. | 1 | 2 | 3 | 4 | 5 |
| C The meeting process we used today helped the group build commitment to implementing the decisions made. | 1 | 2 | 3 | 4 | 5 |
Section F Characteristics of the Decisions Made

This section is concerned with your feelings towards the decisions reached.

8a. How happy were you with the decisions you made as a group?
(please circle your choice)

[ ] very unhappy
[ ] unhappy
[ ] neither happy nor unhappy
[ ] happy
[ ] very happy

8b. If you circled “very unhappy”, “unhappy” or “neither happy nor unhappy”, please give the reason(s) for your answer:

9. Please indicate your level of agreement to the following 6 statements.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The decisions we made today are effective decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>The group made good quality decisions in terms of the amount of time spent reaching the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>The meeting was productive.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>D</td>
<td>Implementing the decisions we have made will bring about the changes intended by the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>The group is committed to implementing the decisions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

10. To what extent did the group achieve its objectives?
(please circle your choice)

[ ] not at all
[ ] to a minor extent
[ ] to a major extent
[ ] fully
Appendix Six: The Revised Questionnaire

Section G Overall Feelings of Satisfaction

This section relates to general aspects of your satisfaction both with the process you used today and with the decisions made.

11. Please indicate your level of agreement to the following 3 statements.

<table>
<thead>
<tr>
<th></th>
<th>strongly disagree</th>
<th>disagree</th>
<th>neither agree nor disagree</th>
<th>agree</th>
<th>strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>The process we used as a group to make decisions made sense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>The decisions we made as a group made sense.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>I would like to use the meeting process we used in a future meeting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

12a. What did you like about the meeting process used by the group in this meeting?

12b. What did you not like about the meeting process used by the group in this meeting?

13a. What did you like about the decisions made in this meeting?
13b. What did you not like about the decisions made in this meeting?

14. If you have any other comments concerning today's meeting process please write them in the space below.

Thank you for taking the time to complete this questionnaire. Your responses are of enormous value to the study of the benefits of meeting processes.