A MULTIPLE-CONSTITUENCY APPROACH TO THE EVALUATION OF DECISION SUPPORT SYSTEMS

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ABSTRACT

Many approaches have been suggested for the evaluation of decision support systems (DSS). Most attempt to produce a single evaluation measure, usually based on the opinions of a single group. As DSS development and use can involve a large number of different people, this approach may be deficient. We propose a framework that takes into account multiple groups or constituencies within the evaluation process and that produces multiple measures of DSS success, one for each group. The framework is designed to be used throughout the development, use and evaluation of the decision support system.

INTRODUCTION

Considerable research has been carried out to determine what constitutes decision support system (DSS) success. This research, however, has concentrated on distinct areas of DSS success, and little effort has been made to produce a cohesive evaluation procedure. Many DSS evaluation methods proceed by identifying a single 'reference group'(usually the users or decision-makers), producing a single evaluation measure, and evaluating the system after development.

In the evaluation of a product, system or organisation it is important to collect information from many individuals. Thus, a number of groups, or constituencies, with differing goals and expected outcomes, may be involved in the evaluation process. It seems logical that each of these constituencies would have its own evaluation measures; however, many authors ignore the existence and significance of these different opinion groups. For example, the 'user' constituency is often identified by researchers, yet, 'non-user management' and 'developer' constituencies are frequently overlooked. The use of a single constituency may not be effective for several reasons: a single evaluation measure may be excessively influenced by a dominant constituency, an important constituency may not be considered in the evaluation, and a single evaluation measure may not be adequate as it does not specifically address each constituency's goals and requirements (Cameron 1980, Connolly *et al.* 1980).

The objective of this paper is to present a multiple-constituency framework for DSS evaluation. The current research in DSS evaluation is summarised, and an approach for the evaluation of organisations is discussed. This approach is then combined with DSS concepts to develop a framework for evaluation that includes the evaluation criteria of many groups.

PAST RESEARCH ON DSS EVALUATION

Many methods for the evaluation of DSS have been suggested. Generally, these are based around the meta-concept of DSS success. Barki and Huff (1990) suggested that four groups of variables should be used in the evaluation of DSS success. These were: the decision-maker, the DSS, the implementation process and the decision environment. Factors, such as: profitability, decision quality, user satisfaction, use and application to major problems within the organisation, were suggested by Ein-Dor and Segev (1978) as important predictors for system success.
Using similar factors, Sanders (1984) developed an instrument designed to evaluate the success of a DSS. This instrument was later used by Sanders and Courtney (1985) in a study that reconfirmed that user training, top management support, and length of DSS use all affect the success of a DSS. The study, however, concentrated only on DSS users. Finlay (1993) suggested that two types of success measures exist within management support systems, MSS (a broader concept than DSS): organisational measures, and intra-MSS measures. Within each of these areas, a hierarchy of success measures exist which are similar to those presented by other researchers.

Other research in the evaluation of DSS refers to a number of attributes of the evaluation process, in particular: satisfaction, efficiency, use and effectiveness. These attributes are often treated by researchers as distinct areas, and are sometimes referred to as surrogates for success. Contention with some of these factors, however, has shown that no single group of factors is generally accepted as a predictor of DSS success. Most research focuses on one of these factors; little, however, has been carried out in terms of the overall evaluation process.

Studies into DSS effectiveness include the concept of 'measures of effectiveness' (Adelman *et al.* 1985), and the use of user-specific characteristics (Ramamurthy *et al.* 1992). Hamilton and Chervany (1981) identified several groups within an organisation which were involved with an MIS. The groups identified each had differing requirements of the system. For example, users were concerned with accuracy, timeliness, reliability and assistance, where management was interested in deadlines, costs, training and workload stabilisation. Many of these factors form the basis for the development of 'measures of effectiveness' as discussed by Adelman *et al.* (1985). The assessment of effectiveness measures in the Adelman *et al.* (1985) study was carried out with the use of a multi-attribute utility assessment technique. The approach was based around three interfaces, the DSS and the user, the user and the organisation, and the organisation and the environment. Effectiveness measures were developed for each criteria within these interfaces, and an overall 'score' for the effectiveness of the system was produced. The use of this method of effectiveness measurement has been extensive (Hopple 1987, Adelman 1989, Adelman and Donnell 1986).

Ramamurthy *et al.* (1992) studied the relationship between user characteristics and a set of effectiveness dimensions. The effectiveness model they developed consisted of four main domains: the task domain, the system domain, the user domain and the organisational domain. Each of these domains influenced DSS performance, efficiency and satisfaction; terms which Ramamurthy *et al.* (1992) equate with effectiveness. Their research was directed primarily toward the user domain and they found that domain expertise, system intelligence, and gender had important effects on DSS effectiveness. The identification of differing domains, or groups, is an important factor displayed by each of these studies. Hamilton and Chervany (1981), however, was the only major study that identified several major groups that should be involved within the evaluation process.

In the MIS field, studies of efficiency measurement mainly dealt with cost, productivity, throughput, objective criteria, and system-oriented assessment (Evans and Riha 1989, Nunamaker *et al.* 1989). Whilst these are important in the evaluation of DSS, the measurement of efficiency is more likely to include the speed and cost of the decision-making process. In essence, for DSS, the question is whether the decision process is any faster or cheaper. Several studies have found that better quality decisions may not be more efficient: a trade-off between efficiency and effectiveness exists (Euske and Dolk 1990, Evans and Riha 1989 and Srinivasan 1985).

Many studies have used satisfaction as a measure of how well a DSS meets users needs. Bailey and Pearson (1983) identified factors that were considered important in assessing user satisfaction of an MIS. Some of these were used by Ives *et al.* (1983) in a further study of MIS, and by Mahmood and Sniezek (1989) in the DSS area. O'Keefe (1989) questioned whether user satisfaction could be used as a valid measure if organisational goals were achieved despite a lack of decision-maker satisfaction. Also, Ginzberg (1978) stated that decision-makers who are involved with system management and development may not be willing to show dissatisfaction as it may reflect adversely on them, whilst Ives *et al.* (1983) suggested that user satisfaction was a good measure of successful performance of a system.

The application of system use as a positive attribute in the evaluation process is generally accepted (Robey 1979, O'Keefe 1989). Yet, there have been as many studies discounting system use as a good indicator of success, as there have been confirming. It is generally accepted, however, that if the use of a system is completely voluntary, then system use is a useful indicator of system success in the evaluation process (Finlay 1993, Barki and Huff 1990, Keen and Scott-Morton 1978). Robey (1979) showed that a strong relationship existed between user attitudes towards a system and the use of that system. Positive associations between satisfaction with a system and system use were found by Lucas (1978). Ein-Dor and Segev (1978) selected system use as the preferred measure of MIS success and Ives and Olson (1984) argued that the use of a system was directly related to user satisfaction. Others argued that system use could not be used reliably as an indicator in the evaluation process (Udo 1992). Schewe (1976) found no significant relationship between the use of a system and the attitudes of users towards that system. This was also observed by Ginzberg (1981) who identified negative or low correlations between system use and user attitudes towards the system.

O'Keefe (1989) suggested that limited use of the system may not indicate failure. The nature of the system may be that it is only used in rare circumstances. For example, it is illogical to suggest that a system used annually, which has a large positive impact on savings, should be considered a failure (Welsh 1980). Also in some circumstances, initial system use may produce a shift in management perceptions and decision-making, resulting in improved effectiveness, but then the system may fall into disuse as it is no longer required (O'Keefe 1989).

Several problems exist with these approaches. Firstly, there is little attention given to the overall evaluation process. Research tends to focus on distinct areas within the evaluation arena rather than synthesising these areas to provide an evaluation process. Secondly, most of the approaches tend to focus only on a single group within the organisation. This limits the evaluation and the DSS greatly, as not all groups within the organisation that may have a stake in the DSS will be involved in the evaluation process. An approach that identifies each of the groups affected by the system, and employs these groups' effectiveness criteria during

an evaluation, may be useful. To this end, researchers in the organisational behaviour area have suggested the use of a multiple-constituency approach (Connolly *et al.* 1980, Cameron 1980).

THE MULTIPLE-CONSTITUENCY APPROACH

Connolly *et al.* (1980) proposed a multiple-constituency approach to evaluation in an attempt to better identify effectiveness within organisations. Rather than selecting an arbitrary effectiveness statement, the multiple-constituency approach is designed to identify the perspectives of multiple strategic constituencies and develop effectiveness statements that consolidate these perspectives. Thus, each constituency should be at least minimally satisfied with the item being evaluated. This process presents several problems: which constituencies should be used, how should obtained criteria be combined, and how should contention between constituencies be solved? Each of these problems must be addressed whenever the multiple-constituency approach is used.

Which constituencies should be used?

The identification of a constituency may be difficult within an organisation. Strategic units, suppliers, customers, system users, and environmental groups each can be thought of as a constituency; but, which of these, if any, should be considered as 'important constituencies'? Cameron and Whetten (1983b) defined a strategic constituency as an individual or group that has some stake in the organisation. Thus, all constituencies that are influenced by the evaluation of the product, system or organisation should be included to some extent in the evaluation process. This enables each constituency to be involved and gives an evaluation that is not excessively biased by a single constituency. The identification of constituencies that should be involved in the evaluation process, however, may be difficult. Often, a constituency may be overlooked as it was not viewed previously as important, or perhaps, was not recognised as a constituency.

Consolidating constituency effectiveness criteria and coping with contention

For ease of evaluation, each constituency would have similar effectiveness criteria. In practice, due to the diversity of individuals and groups this is extremely unlikely. The nature of a constituency, its requirements, goals and objectives, means that competing and potentially incompatible effectiveness criteria may occur across constituencies within the evaluation process. With more traditional evaluation methods, these incompatibilities need to be resolved to enable successful evaluation. With some applications of the multiple-constituency approach, however, the criteria of each constituency are used separately within the evaluation process, thus circumventing the need for compatible effectiveness criteria. Other applications of the multiple-constituency approach attempt to combine effectiveness criteria in some way.

Pfeffer and Salancik (1978) used the most powerful organisational constituency in the development of effectiveness criteria. Others recognised that the selection of the most powerful constituency is difficult, that few organisations depend entirely on only one constituency, and that no organisation would survive by only catering for one constituency as other constituencies would become quickly dissatisfied (Cameron and Whetten 1983b). The

selection of effectiveness measures from only the dominant group would severely bias the evaluation, and could possibly alienate other constituencies.

The idea of the 'dominant coalition' has been suggested by several authors as a concept to enable the consolidation of effectiveness criteria (Pennings and Goodman 1977, Cameron 1980). The dominant coalition is composed of members from a cross-section of constituencies with differing and competing effectiveness expectations. The approach assumes that if the members of the dominant coalition can come to some agreement upon effectiveness factors, then the other constituencies will be satisfied (Pennings and Goodman 1977). This enables each constituency, through their 'dominant coalition' member, to present their effectiveness criteria for discussion and sanctioning by the dominant coalition. In this way, the views of each constituency are presented, argued, and ratified by the dominant coalition through negotiation.

The consolidation of effectiveness criteria can also be carried out using the 'minimal satisfaction' approach. Cameron (1980) defined effectiveness as the extent to which each constituency is at least minimally satisfied. Cameron and Whetten (1983b) pursued this further and stated, '...satisfactory effectiveness is better for the organisation than is maximum effectiveness on any one constituency's criteria'. With the approach, conflicting criteria are identified, and a point on the criteria continuum is identified where each constituency has not yet become dissatisfied. At this point each constituency is minimally satisfied. For example, constituency *C1* may have preferences at one end of the criteria continuum, whilst constituency *C2* may have preferences at the opposite end. At some point along this continuum (in an ideal situation this would be the midpoint) a point would exist where both constituencies *C1* and *C2* are minimally satisfied. This approach requires the evaluator to act as a mediator to identify where each constituency is at least minimally satisfied and, thus, minimise conflict with criteria. The resulting criteria are then used in the evaluation process.

Implications of the multiple-constituency approach

The multiple-constituency approach treats products, information systems or organisations as systems generating differential opinions of effectiveness by different constituencies (Connolly *et al.* 1980). Thus, unlike other evaluation approaches, a single measure is not generated. This may preclude a comparison of effectiveness between two products, systems or organisations as many differing measures for constituencies with differing characteristics would be produced by each evaluation. This may not be important, however, as it is how the system rates in the eyes of those who are involved, that may be the important factor.

Unlike some techniques, the multiple-constituency approach allows for the recognition of constituencies that are new, only important on occasions, or have ceased to be important. Thus, changes within the organisation are identified and any changes that need to be made to the constituencies involved with the evaluation process could be put into place. This would enable continual, valid evaluation to take place over extensive time periods.

CONSTITUENCY IDENTIFICATION IN DSS EVALUATION RESEARCH

The concept of multiple-constituencies within the process of decision support system evaluation may be valuable. Like organisational evaluation, the DSS evaluation process may deal with a number of constituencies, each having differing, even mutually exclusive, evaluation criteria. Early DSS literature identified several constituencies from a development

viewpoint. Keen (1980) in his adaptive DSS design model, showed the builder and user as important constituencies in DSS development. Sprague and Carlson (1982) identified several constituencies involved within their Tools-Generator-Systems paradigm, such as: tool-smiths, technical supporters, DSS builders, intermediaries and users.

Table 1 shows a catalogue of studies where more than one group was consulted during the evaluation process. Clearly, similarities exist with the constituencies identified in the Table. The decision-maker, often called the user, is consistently identified, as are the developers of the system. Management and the 'organisation', are also frequently identified as constituent groups. In addition, direct users of the DSS, as distinct from decision-makers who are indirect users, are identified as a further constituency.

Study	**Constituencies Informally Identified**
Hamilton and Chervany (1981)	user, manager and builder
Ramamurthy *et al.* (1992)	user and the organisation
Ahituv and Getz (1986)	tool builder, DSS builder, intermediary and decision-maker
Sanders and Courtney (1985)	managers, financial planners and 'others'
Watson *et al.* (1987)	management, users and the DSS group
Rainer (1989)	executives, providers and vendors
Mahmood and Sniezek (1989)	management, indirect users and direct users

Table 1: A Catalogue of Constituencies Identified in DSS Evaluation Studies

In the past, evaluation approaches have been characterised by the production of a single evaluation measure. Rather than a single overall measure it may be advantageous to produce measures for each constituency. For example, it may be beneficial to know that management finds the system highly effective, that customers find it moderately effective, but that operators find it barely adequate, rather than just being told that the system is effective. Each of the studies in Table 1, with the exception of Mahmood and Sniezek (1989) aggregate evaluation outcomes to produce a single evaluation measure. This increases the difficulty of identifying how to improve the system, as improvements would only be based on the aggregate of the evaluation outcomes, rather than according to the requirements of groups important to the success of the DSS.

Through the use of multiple outcomes, constituencies can be presented with more appropriate information as to where the DSS is meeting or not meeting their requirements. As a result constituencies can better guide the direction of DSS development so that it is in line with their requirements. A multiple-constituency approach to DSS evaluation can only be of benefit to the total development process if the cost and time of the evaluation process is sufficiently small relevant to the total project.

A MULTIPLE-CONSTITUENCY APPROACH TO DSS EVALUATION

The framework, presented in Figure 1, is an idealised model developed using concepts from past DSS evaluation research, and incorporating multiple-constituency theory from the organisational behaviour discipline. The framework is designed to be used as an evaluation tool from the initial stages of DSS development (system version 0), throughout its life (system version *n*). It consists of two distinct, but closely related sub-systems: the

development and use sub-system, and the evaluation sub-system. These sub-systems act in an interactive, even homeostatic manner. Constituencies involved with the DSS develop evaluation criteria which are used in the evaluation process. Evaluation outcomes are produced which are then fed back to the constituencies to enable further use and development of the system.

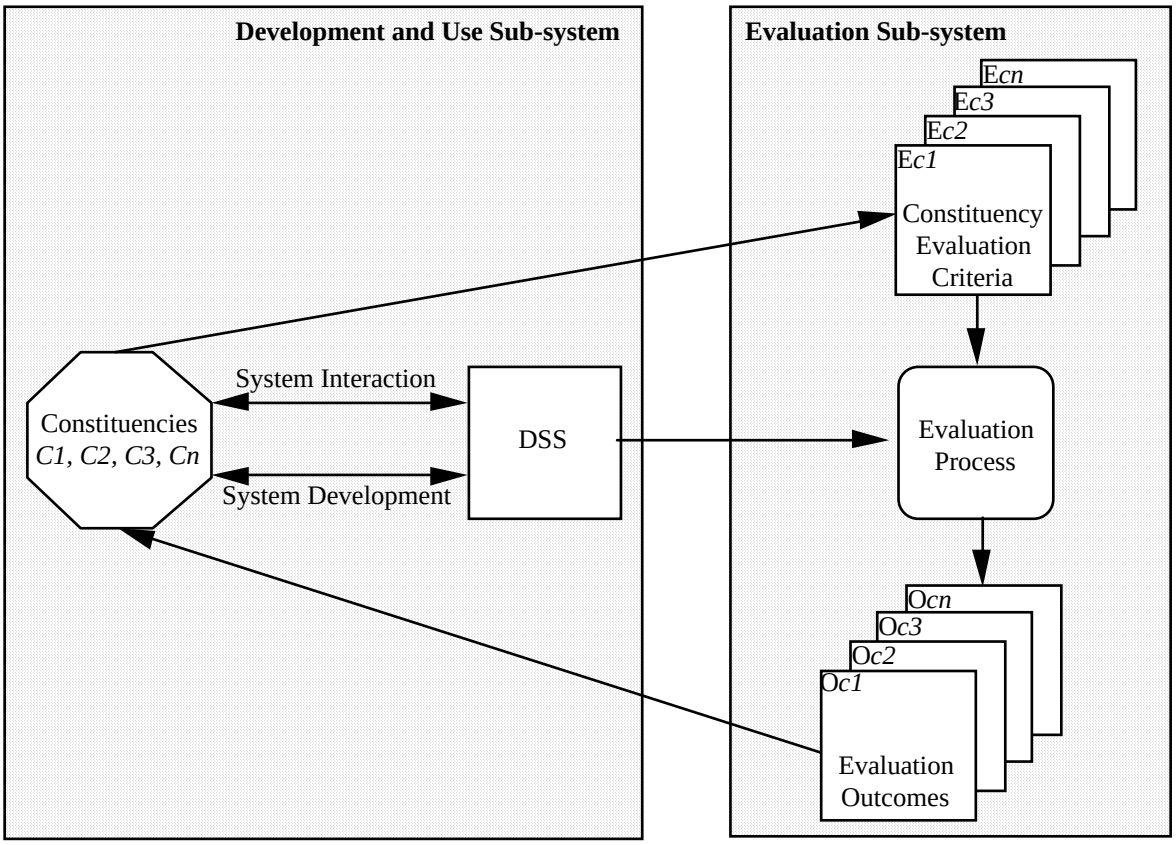

Figure 1: A Framework for Multiple-constituency DSS Evaluation

Development and use sub-system

The development and use sub-system consists of the DSS and the constituencies involved with the DSS. The DSS will normally progress through many stages in an evolutionary manner. Initially, the DSS may only be an idea that takes on a more concrete appearance only after evaluation criteria are produced and some development has taken place. As the development cycle progresses, many versions of the DSS will be produced, each being evaluated in turn. The DSS embodies various high-level objectives, as well as the physical system that is utilised by direct users.

As discussed previously, research in DSS evaluation has identified several constituencies within organisations that may be consulted in the evaluation process: direct users, decision-makers, builders and managers (Hamilton and Chervany 1981, Ramamurthy *et al.* 1992, Ahituv and Getz 1986, Sanders and Courtney 1985, Watson *et al.* 1987, Rainer 1989,

Mahmood and Sniezek 1989). There may also be other relevant constituencies; for instance, customers, suppliers or government agencies may be important constituencies in some systems. In addition, within these constituencies a number of smaller constituencies may exist, possibly at an individual level. For instance, several types of direct users may exist, possibly at different levels within the organisation, each having differing requirements of the system. Difficulties arise when members of a constituency exhibit conflicting attitudes. When this occurs, it may be possible that the constituency will need to be broken into several other constituencies due to the diversity of opinions expressed by the various sub-groups.

The link between constituencies and the DSS in Figure 1 is two-fold. It shows the relationship between the DSS and constituencies, whether this is *system interaction* or *system development*. In order for constituencies to effectively form evaluation criteria they must have some sort of interaction with the system or the development process. For direct users, this may be the use of the system. Other constituencies, such as builders or management may be more interested in other aspects of the system, such as efficiency. Thus, the *system interaction* link is concerned in some part with the formation of evaluation criteria, but primarily in the application of the system to its intended tasks.

The *system development* link provides constituencies with the opportunity to apply the outcome of the evaluation process, amongst other processes, to change the system. Due to differing constituency requirements, backgrounds and experience, contention may exist between constituencies as to which system functions should be improved to meet constituency criteria. For example, efficiency may be important to management, yet direct users could be more interested in effectiveness. For large or complex systems this presents little problem as each constituency may have its own view of the system. In small or simple systems, however, it is important that contention be reduced. This can be accomplished in several ways. A working group could be formed consisting of members from each constituency to negotiate a stance. Alternatively, a questionnaire may be utilised which is completed by each individual within each constituency to determine those criteria that are considered most important overall. Whichever method is selected, the goal is to improve the system based on the outcomes of the evaluation process.

Evaluation sub-system

The key to the evaluation process is the identification of evaluation criteria for each constituency. To develop evaluation criteria, members of constituencies may wish to hold meetings to elicit individual evaluation criteria and to produce a list of ranked criteria for the constituency. Alternatively, a questionnaire-based method could be used to identify criteria of individual constituents and then a further questionnaire (or a meeting) could be conducted to rank these evaluation criteria. Other methods that could be used to elicit evaluation criteria include: critical success factors (Rockart 1979), critical failure factors (Burkan 1991) and knowledge elicitation techniques (Bainbridge 1986).

Contention, as discussed previously, may exist between constituencies. Contention, however, may not be limited to inter-constituency conflict, but may exist within a single constituency. For example, higher-level direct users may be more interested in justifying their use of the system, where for lower-level direct users this may be of little or no interest. These incompatible criteria may be resolved through negotiation, or by a ranking process, regardless of the elicitation method that is used. If this is not possible, it may be necessary for those holding different views to those of the norm to be classed as a separate constituency.

The evaluation process takes the ranked evaluation criteria of each constituency, groups them according to attributes identified by past studies (effectiveness, satisfaction, use and efficiency), and determines how well the criteria of each constituency are met by the system. Generally, this is completed using questionnaire type methods for subjective measures and direct measurement for objective measures. The evaluation process naturally requires measurement of aspects of the DSS to enable its evaluation. For example, the use of the system, its overall objectives and measures of the systems efficiency may all be required as inputs to the evaluation process.

Several options are available as to those who control the evaluation process. It may be that one of the constituencies, possibly developers for instance, conducts the evaluation, or perhaps a group is formed containing members from each constituency. Alternatively, specialists in the evaluation of DSS may be used to control the evaluation. Without careful selection of the evaluation team, the evaluation process may develop into little more than a farce. A strongly biased evaluation team, for instance, may select only those criteria they consider to be important and weight these criteria inappropriately. For example, the secretarial constituency's preferences could be rated higher than those of the management constituency. This may be inappropriate depending on the system undergoing evaluation.

At the conclusion of a repetition of the evaluation process, the system is rated for each constituency. The evaluation rating indicates how well the system has performed according to the constituency's evaluation criteria. This provides information as to what requirements from each constituency are not being met and may enable the improvement in quality of the system. The system rating for each constituency can be compared with previous ratings of the same constituency to determine how the system has progressed for each constituency over time. This will enable constituencies to determine where the system has failed them in the past, where it has been successful, and will allow the formation of new evaluation criteria.

Each constituency's criteria ratings from the evaluation process will enable constituencies to determine the criteria that are, or are not, being met by the system. Criteria not being met by the system could then be used to determine how to improve the system for each constituency. This process may result, once again, in conflicting factors. For example, constituency (C1) may have suggestions to improve the system that cannot be implemented with another's (C3). To enable improvement to a simple DSS it may be important to resolve these incompatibilities, or at least to minimally satisfy each constituency. This may be accomplished using similar methods to those used when resolving criteria incompatibilities as discussed previously. For a more complex, perhaps multi-faceted DSS, each constituency should be able to implement the changes it deems necessary as long as they do not affect another constituency.

CONCLUDING REMARKS

The evaluation approach presented here is designed to improve the quality of DSS though a process of continuous evaluation which recognises the importance of a number of constituencies in the development process. The approach draws heavily on research and experience in the organisational behaviour discipline. Unlike past approaches to DSS evaluation it does not attempt to advocate the derivation of a single measure of system success.

Research is currently being conducted to identify the evaluation criteria of DSS constituency stereotypes, how the desires of different constituencies can be accommodated in system evolution and how such an evaluation process can be best integrated with DSS development.

The multiple-constituency approach lends itself to computer support of the evaluation process. By using a computer-based instrument the intrusiveness and the time devoted to evaluation may be dramatically reduced.

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